Since 1938

WADSWORTH/ALERT
LABORATORIES, INC.
Sampling, testing, mobile labs
4101 Shuffel Dr. N.W.
North Canton, Ohio 44720

QUALITY ASSURANCE PROGRAM PLAN

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NOTICE

This document is Wadsworth/ALERT Laboratories' Quality Assurance Program [illegible]n. It is a generic document summarizing the management policies, objectives, organization, and general procedures by which our laboratory achieves acceptable data quality. It is not intended for site-specific application. The contents and format of this document are as specified in EPA 600/4-83-004, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans," 1983.

Analytical chemistry laboratory services for the IWD RI/FS will be provided by Wadsworth Alert Laboratory. Chen-Northern will perform the laboratory work associated with the geochemical analyses discussed in the hydrogeological investigation. Daniel B. Stephens and Associates will perform the physical property analysis work.

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1.0 INTRODUCTION, OBJECTIVES AND POLICIES

1.1 Introduction

Wadsworth/ALERT Laboratories, Inc. is an independent testing laboratory organized to deliver comprehensive, reliable analytical services to its clients in a responsive, complete manner. Founded in 1938, Wadsworth/ALERT Laboratories has been a leading independent testing laboratory for over 50 years. The main laboratories and headquarters are located in North Canton, Ohio; with other facilities in Cleveland, Ohio; Bartow, Florida; and Pittsburgh, Pennsylvania. Additional sales offices are located in Lexington, South Carolina; Oviedo, Florida; and Tecumseh, Michigan.

ANALYTICAL SERVICES

Wadsworth/ALERT Laboratories provides a number of environmental analytical services which aid private industry, engineering consultants, and government agencies with technical aspects of environmental control and regulatory compliance. These analytical services are designed to fulfill the analytical requirements of major federal and state environmental regulations. A brief outline of these major environmental regulations and related analytical services follows:

CERCLA-ENVIRONMENTAL ASSESSMENTS AND REMEDIAL ACTION

Remedial Investigations and Feasibility Studies
- Groundwater/Surface Water Evaluations
  - Complete Analytical Characterizations
    - Organic
      - Volatiles and Semi-Volatiles
      - Target Compound List (TCL) Parameters
      - Appendix III, VII, IX Constituents
      - Herbicides, Pesticide, PCBs
      - Trihalomethanes (THMs)
      - TOC, POC, TOX
    - Inorganic
      - Phenols, Cyanide
      - Metals
      - Conventional Pollutants - BOD, COD, etc.
- Soil/Sediment, Subsurface Investigations
  - Complete Analytical Characterizations (as above)
- Surface Surveys and Investigation
  - Wipes, Scrapes, Swabs, etc.

CERCLA-ENVIRONMENTAL ASSESSMENTS AND REMEDIAL ACTION (Cont.)

Remedial Action Monitoring and Evaluations
Clean-up Monitoring and Evaluation
Treatment System Evaluation and Monitoring
Compliance Monitoring and Evaluation
Quality Control Verification
Long-Term Compliance Verification
Participation in the USEPA Contract Laboratory Program under contract # 68-D1-0085. Multi-Media,Multi-Concentration Organic analyses and associated qualtiy control data are performed in accordance with Statement of Work OLM01.8. Inorganic analyses with associated quality control data are performed in accordance with Statement of Work ILM02.0.

RCRA-HAZARDOUS WASTE

Hazardous Waste Identification
Characteristic Waste Parameters
Ignitability
Reactivity
Corrosivity
EP Toxicity, TCLP Analysis
Appendix VIII Compounds (40 CFR 261)
Delisting Petitions and Exclusions
Sludges, Specific Waste Streams
Landfill Ban Parameters
Solvent Scans
California List
TCLP
Waste Materials Profiles for Disposal
Chemical Composition
Organic Constituents
Inorganic, Non-Metallic Constituents
Metals
Physical Properties
Waste Compatibility and Consolidation
Groundwater Monitoring
Detection Monitoring
Suitability, Quality, and Contamination Parameters
Radioactivity
Compliance Monitoring
Appendix IX (40 CFR 264)
Corrective Action Monitoring
Closure and Post-Closure
Closure Performance Standard Analyses
Post-Closure Monitoring

TSCA SURVEYS

PCB Surveys
  Environmental Surveys
    Air, Water, Soil
  Waste Product Surveys
    Oils, Fluids, Waxes, Sludges
Factory-Wide Contamination Surveys

SWDA-DRINKING WATER

Compliance Monitoring and Evaluation
  Primary Drinking Water Parameters
    Herbicides, Pesticides
    Trihalomethanes (THMs)
    Metals, Inorganics
    Volatile Organic Compounds
      Eight Regulated
      Fifty-One Unregulated
  Secondary Drinking Water Parameters
    Metals, Inorganics
Treatment System Monitoring and Evaluation

NPDES AND INDUSTRIAL PRETREATMENT PROGRAMS

Permitting and Compliance Monitoring
  Water, Wastewater, & Industrial Effluent Analysis
    EPA Form 2C Analysis
      Parts A, B, & C
    Priority Pollutants
    Total Toxic Organics (TTOs)
    Biomonitoring
Treatment System Monitoring and Evaluation
Surface Water/Sediment Analysis

1.2 Objectives and Policies

The objective of Wadsworth/ALERT Laboratories' Quality Assurance/ Quality Control Program is to provide legally and scientifically valid laboratory services. This QA/QC program directs organizational adherence to a system of mandatory operating practices and procedures which ensure that all generated laboratory data are scientifically correct, legally defensible, and fulfilling of applicable regulatory requirements. These component QA/QC operating procedures involve both technical and evidentiary aspects of all Wadsworth/ALERT Laboratories sampling and analytical services, including mobile laboratory operations. These procedures are documented in the Laboratory Quality Control SOP Manual, which is available for inspection at the laboratory.

Wadsworth/ALERT Laboratories' QA/QC program contains component Sampling and Analytical Quality Control Programs. The Sampling QC Program combines appropriate technical sample collection, preservation, and transport considerations with evidentiary documentation and chain-of-custody possession requirements. The Analytical QC Program provides a system of standard operating procedures which maintain high quality standards of operation throughout all laboratory analytical activities. In addition, this Analytical QC Program provides continuous, documented surveillance and evaluation of acceptable analytical method performance through the systematic insertion of various quality control samples into at least 10% of all laboratory analyses.

For the purpose of this document, the term Laboratory refers to Wadsworth/ALERT Laboratories and Mobile Operations refers to the mobile on-site laboratories operated by Wadsworth/ALERT Laboratories.

2.0 PROJECT DESCRIPTION - NOT USED

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3.0 LABORATORY RESPONSIBILITY AND ORGANIZATION

The general responsibilities of key personnel with respect to QA/QC are as follows: (see Figures 3-1 and 3-2 for an organizational flowchart)

3.1 Laboratory Technical Director

The Laboratory Technical Director establishes and directs all activities (including mobile laboratory operations) relating to analytical QA/QC, and represents the organization accordingly. The Laboratory Technical Director reports to the Corporate President.

3.2 Laboratory Operations Director

The Laboratory Operations Director is responsible for the planning of the analytical growth and development of all laboratory sites (including mobile laboratory operations). This person is involved in productivity assessments for each facility and determines the direction each will take to meet the analytical needs of the client. Additional responsibilities include ensuring that all analytical programs comply with regulatory needs. The Laboratory Operations Director reports to the Corporate President.

3.3 Business Development Director

The Laboratory Business Development Director is responsible for coordinating the Project Management and Marketing efforts of the Laboratory. This involves cooperative ventures with the Laboratory Operations Director in ensuring that the analytical needs of the client are met and with the Laboratory Technical Director in ensuring that the client's Data Quality Objectives are met. The Business Development Director reports to the Corporate President.

3.4 Laboratory Manager

The Laboratory Manager's duties and responsibilities include the following:

- Direct the laboratory's analytical programs, including mobile laboratory activities.
- Coordinate projects and associated workloads.
- Execute laboratory administrative functions.

- Ensure compliance with appropriate analytical method and instrument performance specifications (see Chapters 8 and 9).

The Laboratory Manager reports to the Laboratory Operations Director.

3.5 Quality Assurance Manager

The Laboratory Quality Assurance Manager supervises QA functions pertaining to laboratory analytical operations. These responsibilities include ensuring that laboratory standard operating procedures meet current industry standards. The Quality Assurance Manager is also responsible for the implementation and supervision of the Laboratory Training Program.

The Laboratory Quality Assurance Officer reports to the Laboratory Technical Director.

3.6 Quality Control Manager

The Laboratory Quality Control Manager implements, supervises, and evaluates QC functions pertaining to all laboratory analytical operations, including mobile laboratory analyses. Primary duties include the following:

- Managing certification and approval programs.
- Maintaining precision and accuracy records for each analytical parameter.
- Conducting internal QC audits.
- Overseeing corrective action as indicated by internal QC data.
- Implementing, supervising, and evaluating Internal Quality Control Program (see Chapter 11).
- Administering and evaluating Performance and System Audits (see Chapter 12).
- Assessing data precision, accuracy, and completeness (see Chapter 14).
- Enforcing corrective action measures (see Chapter 15).

The Laboratory Quality Control Manager reports to the Laboratory Technical Director. The Mobile Laboratory QC designee assumes the on-site QC duties and reports to the Laboratory Quality Control Manager.

3.7 Sample Custodians

The Sample Custodians' duties and responsibilities include the following:

- Ensuring that all submitted samples are properly accepted into the laboratory in accordance with documented sample acceptance procedures (see Chapter 6.13).
- Ensuring that associated sample acceptance data is entered into the laboratory data management systems (see Chapter 6.13).
- Arranging proper secure sample storage (see Chapter 6.13).

The Sample Custodians report to the Laboratory Manager. The Mobile Laboratory Sample Custodian designee assumes on-site custodian duties and reports to the Laboratory Sample Custodian.

3.8 Analytical Group Coordinators

The Analytical Group Coordinators' duties and responsibilities include the following:

- Implementing and supervising all analytical activities pertaining to their respective analytical groups (GC, GC/MS, Inorganics, etc.).
- Coordinating projects and workloads.
- Reviewing raw data and analytical results (see Chapters 8 and 9).

The Analytical Group Coordinators report to the Laboratory Manager. The Mobile Laboratory Group Coordinator designee assumes on-site coordinator responsibilities and reports to the respective Laboratory Analytical Group Coordinator.

3.9 Analysts

An analyst's duties and responsibilities include the following:

- Equipment maintenance (see Chapter 13).
- Equipment calibration (see Chapter 8).
- Sample extraction and analysis (see Chapter 9).

- Raw data manipulation and reporting (see Chapter 10).

- Inclusion of appropriate QC samples and considerations into all laboratory operations (see Chapter 11).

Analysts report to their respective Analytical Group Coordinator. Mobile laboratory analysts report to the Mobile Laboratory Group Coordinator designee.

3.10 Project Managers

The Project Managers are responsible for overseeing the timely completion of all major projects. They ensure that client quality assurance objectives are met and that project problems associated with any facet of the laboratory are addressed in a narrative to the client. The Project Managers report to the Laboratory Business Development Director.

3.11 Personnel Training

3.11.1 New Laboratory Personnel

During the initial weeks of employment, new laboratory personnel are involved with several training sessions. These may include: quality control, health and safety, regulatory information, sample receiving procedures, and introduction to methods. Before performing analyses, analysts are trained in the laboratory by experienced analysts using the laboratory SOPs and under the guidance of the Quality Assurance Manager. Accurate analysis of performance evaluation samples is required prior to beginning work on actual client samples. This sequence of training is recorded in the employees' permanent records in the Personnel Department.

3.11.2 Instrumentation

All Laboratory analysts receive proper training in the operation of applicable instrumentation prior to actual sample analysis. This training may combine attendance at various instrument manufacturer's operator training classes and seminars with actual in-lab instruction and supervision by the group coordinator or his/her designee. This training is recorded in the employees permanent record in the Personnel Department.

3.11.3 Quality Control

The main purposes of the Quality Control training program are to introduce the Quality Control staff and to explain Laboratory Quality Control requirements. All laboratory analytical staff are required to complete the program. A brief outline of the program is as follows:

- Introduce the Quality Control staff and briefly outline each function within the department.
- Review the purposes and corrective actions for blanks, check samples, and spikes. Explain corrective action flowchart.
- Explain and show control limits and control charts - how and why they are used, what constitutes a trend, corrective action for trends.
- Emphasize documentation of laboratory data and any problems encountered.
- Explain QC reporting requirements.
- Offer assistance with problems encountered in the laboratory.

The training program is augmented and updated as appropriate.

3.11.4 Safety Program

All new employees who are routinely exposed to toxic substances must participate in an education and training program. The program commences prior to initial assignment and is repeated on an annual basis.

For those employees currently working in areas where toxic substances are used on a routine basis, an education and training program is administered on an annual basis.

For those employees using toxic substances in abnormal situations, training is provided prior to handling the substance and is administered on an as needed basis as determined by the supervisor.

Group Coordinators are responsible for ensuring that all employees working in their group are using proper safety procedures at all times (as documented in the Safety Manual). They are responsible for seeing that any new employee entering their group has received the proper safety training before work begins, and are responsible for implementing the Safety Committee's recommendations as quickly as possible. Group Coordinators should help employees develop good personal chemical hygiene habits.

The following protocols are used whenever handling toxic substances:

- Employees must confine any work done with toxic substances to a regulated area. A regulated area is defined as an area within the laboratory to which access is limited to persons who are aware of the hazards in use and the precautions that must be used. (Such areas would be fume hoods and specifically designated preparation areas.)

- The following protective apparel must be worn at all times when using/handling toxic substances:

    - Safety glasses
    - Laboratory coat
    - Gloves
    - A respirator must be immediately available

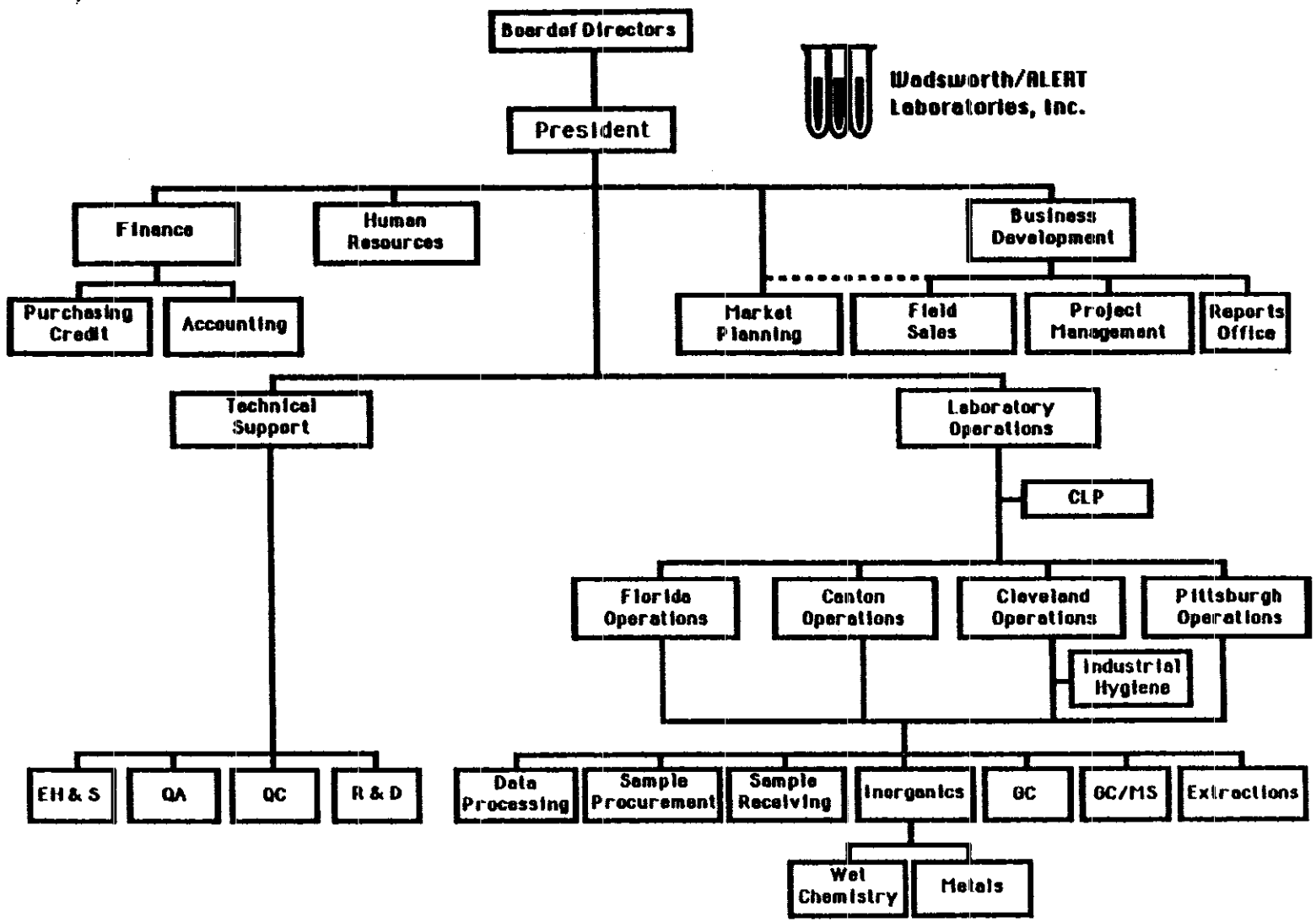
- The following personal hygiene must be used within and immediately upon leaving a regulated area:

    - Hands must be washed thoroughly
    - Gloves must be disposed of in a proper container.

- All laboratory safety procedures must be followed whenever handling toxic substances. These safety procedures are listed in the Safety Manual and include the following:

    - Labeling
    - Chemical Storage
    - Spills
    - Fire Safety
    - Disposal
    - Handling Procedures

Figure 3-1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Accounting
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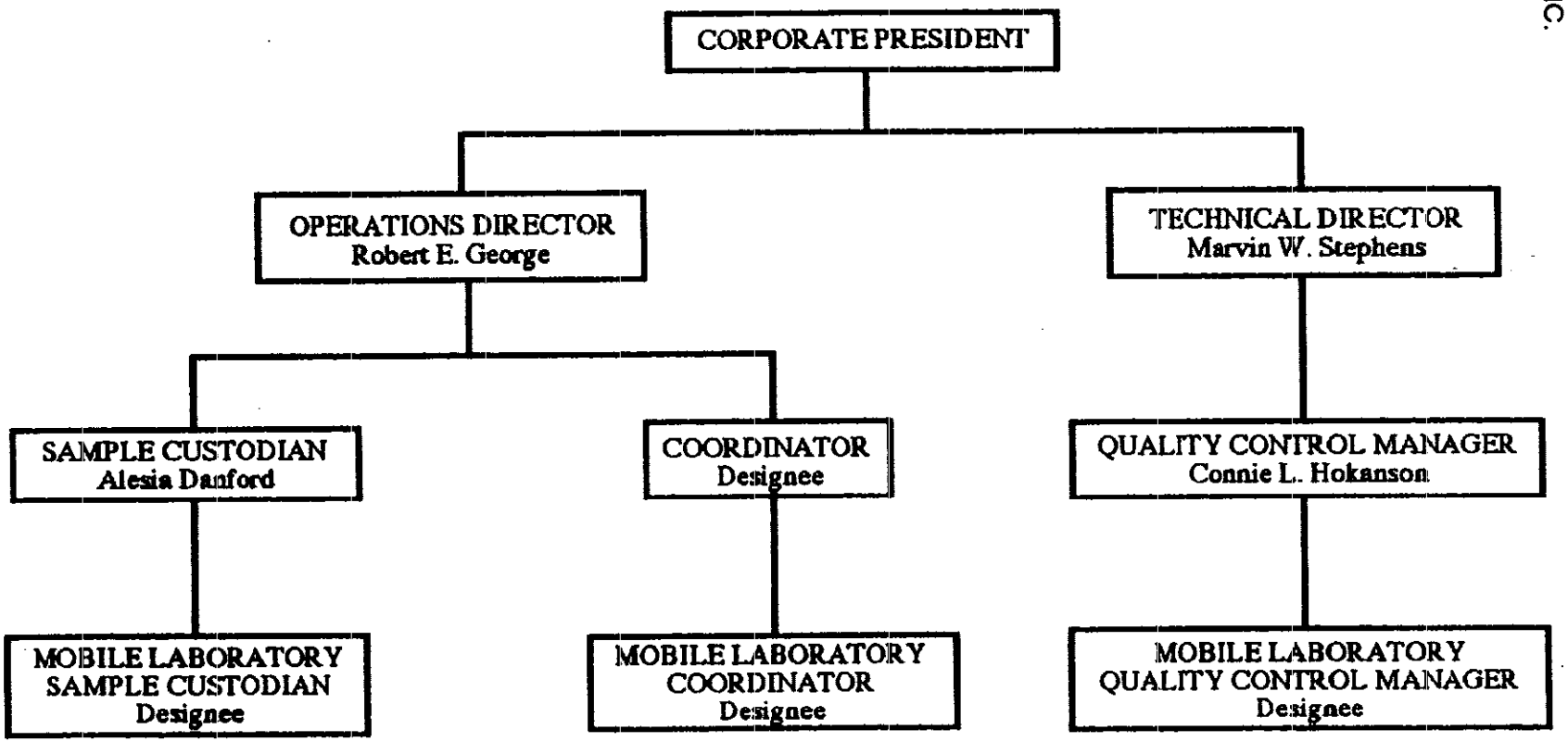
Technical Support
Laboratory Operations
CLP
Florida Operations
Canton Operations
Cleveland Operations
Pittsburgh Operations
Industrial Hygiene
EH & S
QA
QC
R & D
Data Processing
Sample Procurement
Sample Receiving
Inorganics
GC
GC/MS
Extractions
Wet Chemistry
Metals

FIGURE 3-2

WADSWORTH/ALERT LABORATORIES, INC.
ORGANIZATIONAL CHART
MOBILE LABORATORY



4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, AND COMPLETENESS

The objective of Wadsworth/ALERT's Laboratory Quality Assurance Program is to provide legally and scientifically valid laboratory data which meet acceptable analytical accuracy, precision, and completeness criteria. These terms are defined below.

ACCURACY[1] -- The degree of agreement of a measured value with the true or expected value. In-house generated accuracy limits are presented as an average recovery plus or minus three (3) standard deviations.

PRECISION[1] -- The degree of mutual agreement characteristic of independent measurements as a result of repeated application of a process under specified conditions. In-house generated precision values are presented as the average percent relative standard deviation of a set of data.

COMPLETENESS[1] -- A measure of the amount of data obtained from a measurement process compared to the amount that was expected to be obtained.

The accuracy, precision, and completeness values are based upon historical data and method validation studies using spikes, replicates and standards. EPA method control data is used if applicable. Advisory limits are presented for parameters which do not have a data base large enough to calculate a reliable value in a multi-analyst laboratory. Advisory limits are based on good laboratory practice and, in most cases, are less than or equal to those measured for similar compounds within the same method.

To collect data on compounds for which advisory limits are stated, the Laboratory is implementing a rotating spike recovery program. As soon as data is made available, the advisory limits will be phased out.

TABLE 4-1 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 501.1 - ANALYSIS OF TRIHALOMETHANES IN DRINKING WATER[10]

Matrix: Drinking Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Chloroform	10	83-119	95
Bromodichloromethane	10	85-115	95
Dibromochloromethane	10	85-112	95
Bromoform	10	81-129	95

TABLE 4-2 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 502.2 - VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTOIONIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES[11]

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Benzene	9[6]	68-124[6]	95
Bromobenzene	10	96-106	95
Bromochloromethane	10	86-114	95
Bromodichloromethane	10	85-115	95
Bromoform	10	81-129	95
Bromomethane	10	88-112	95
n-Butylbenzene	10	78-138	95
sec-Butylbenzene	10	88-130	95
tert-Butylbenzene	10	92-116	95
Carbon tetrachloride	10	74-122	95
Chlorobenzene	8[6]	73-119[6]	95
Chloroethane	10	88-112	95
Chloroform	10	86-116	95
Chloromethane	16	56-164	95
2-Chlorotoluene	10	94-118	95
4-Chlorotoluene	10	76-118	95
Dibromochloromethane	10	85-112	95
1,2-Dibromo-3-chloropropane	22	39-195	95
1,2-Dibromoethane	10	86-116	95
Dibromomethane	10	85-115	95
1,2-Dichlorobenzene	10	91-121	95
1,3-Dichlorobenzene	10	85-127	95
1,4-Dichlorobenzene	10	86-116	95
Dichlorodifluoromethane	19	45-165	95

TABLE 4-2 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 502.2 - VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTOIONIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTOR IN SERIES[11] (Continued)

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
1,1-Dichloroethane	10	91-111	95
1,2-Dichloroethane	10	91-109	95
1,1-Dichloroethene	8[6]	67-115[6]	95
cis-1,2-Dichloroethene	10	94-106	95
trans-1,2-Dichloroethene	10	78-126	95
1,2-Dichloropropane	10	88-112	95
1,3-Dichloropropane	10	90-114	95
2,2-Dichloropropane	10	78-126	95
1,1-Dichloropropene	10	87-111	95
cis-1,3-Dichloropropene	10	89-113	95
trans-1,3-Dichloropropene	10	84-114	95
Ethylbenzene	10	92-112	95
Hexachlorobutadiene	10	81-125	95
Isopropylbenzene	10	89-119	95
p-Isopropyltoluene	10	73-133	95
Methylene chloride	11	60-132	95
Naphthalene	15	61-157	95
n-Propylbenzene	10	92-112	95
Styrene	11	69-135	95
1,1,1,2-Tetrachloroethane	10	83-111	95
1,1,2,2-Tetrachloroethane	10	82-112	95
Tetrachloroethene	10	85-121	95
Toluene	9[6]	67-120[6]	95
1,2,3-Trichlorobenzene	14	63-153	95
1,2,4-Trichlorobenzene	11	69-141	95
1,1,1-Trichloroethane	10	89-101	95
1,1,2-Trichloroethane	10	86-110	95
Trichloroethene	9[6]	72-122[6]	95
Trichlorofluoromethane	10	77-137	95
1,2,3-Trichloropropane	10	90-120	95
1,2,4-Trimethylbenzene	10	70-136	95
1,3,5-Trimethylbenzene	10	74-140	95
Vinyl chloride	12	70-154	95
o-Xylene	16	77-107	95
m-Xylene	10	79-133	95
p-Xylene	10	69-123	95

TABLE 4-3 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 509A - ORGANOCHLORINE PESTICIDES

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Endrin	20	56-121[6]	95
Lindane	20	56-123[6]	95
Methoxychlor	22[4]	53-159[4]	95
Toxaphene	14	41-126	95

TABLE 4-4 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 509B - CHLORINATED PHENOXY ACID HERBICIDES[12]

Matrix: Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
2,4-D	20	25-142	95
2,4,5-T	29	25-142	95
2,4,5-TP (Silvex)	19	25-142	95

TABLE 4-5 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 601 - PURGEABLE HALOCARBONS[2]

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Bromodichloromethane	10	85-115	95
Bromoform	10	81-129	95
Bromomethane	10	88-112	95
Carbon tetrachloride	10	74-122	95
Chlorobenzene	8[6]	73-119[6]	95
Chloroethane	10	88-112	95
2-Chloroethylvinyl ether	29[5]	14-186[5]	95
Chloroform	10	86-116	95
Chloromethane	16	56-164	95
Dibromochloromethane	10	100-112	95
1,2-Dichlorobenzene	10	91-121	95
1,3-Dichlorobenzene	10	85-127	95
1,4-Dichlorobenzene	10	86-116	95
1,1-Dichloroethane	10	91-111	95

TABLE 4-5 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 601 - PURGEABLE HALOCARBONS[2] (Continued)

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
1,2-Dichloroethane	10	91-109	95
1,1-Dichloroethene	9[6]	67-115[6]	95
trans-1,2-Dichloroethene	10	78-126	95
1,2-Dichloropropane	10	88-112	95
cis-1,3-Dichloropropene	10	89-113	95
trans-1,3-Dichloropropene	10	84-114	95
Methylene chloride	11	60-132	95
1,1,2,2-Tetrachloroethane	10	82-112	95
Tetrachloroethene	10	85-121	95
1,1,1,-Trichloroethane	10	89-101	95
1,1,2-Trichloroethane	10	86-110	95
Trichloroethene	10	83-119	95
Trichlorofluoromethane	10	77-137	95
Vinyl chloride	12	70-154	95

TABLE 4-6 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 602 - PURGEABLE AROMATICS[2]

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Benzene	9[6]	68-120[6]	95
Chlorobenzene	8[6]	73-119[6]	95
1,2-Dichlorobenzene	10	82-124	95
1,3-Dichlorobenzene	10	88-126	95
1,4-Dichlorobenzene	10	82-118	95
Ethylbenzene	10	92-112	95
Toluene	9[6]	67-120[6]	95

TABLE 4-7 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 608 - ORGANOCHLORINE PESTICIDES AND PCBS[2]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Aldrin	16	42-122	95
a-BHC	19	37-134	95
b-BHC	26	17-147	95
g-BHC (Lindane)	25	19-140	95
d-BHC	20	32-127	95
Chlordane	15	45-119	95
4,4'-DDD	21	31-141	95
4,4'-DDE	22	30-146	95
4,4'-DDT	24	25-160	95
Dieldrin	20	36-146	95
Endosulfan I	18	45-153	95
Endosulfan II	33	D-202	95
Endosulfan sulfate	23	26-144	95
Endrin	22	30-147	95
Endrin aldehyde	20[4]	30-147[4]	95
Heptachlor	18	34-111	95
Heptachlor epoxide	20	37-142	95
Toxaphene	17	41-126	95
PCB-1016	13	50-114	95
PCB-1221	32	15-178	95
PCB-1232	30	10-215	95
PCB-1242	20	39-150	95
PCB-1248	20	38-158	95
PCB-1254	21	29-131	95
PCB-1260	20	8-127	95

TABLE 4-8 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 610 - POLYNUCLEAR AROMATIC HYDROCARBONS[2]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	33	D-124	95
Acenaphthylene	33	D-139	95
Anthracene	33	D-126	95
Benzo(a)anthracene	28	12-135	95
Benzo(b)fluoranthene	31	6-150	95
Benzo(k)fluoranthene	33	D-159	95

TABLE 4-8 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 610 - POLYNUCLEAR AROMATIC HYDROCARBONS[2] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzo(g,h,i)perylene	33	D-116	95
Benzo(a)pyrene	33	D-128	95
Chrysene	33	D-199	95
Dibenzo(a,h)anthracene	33	D-110	95
Fluoranthene	26	14-123	95
Fluorene	33	D-142	95
Indeno(1,2,3-cd)pyrene	33	D-116	95
1-Methylnaphthalene	33	D-122[4]	95
2-Methylnaphthalene	33	D-122[4]	95
Naphthalene	33	D-122	95
Phenanthrene	33	D-155	95
Pyrene	33	D-140	95

TABLE 4-9 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 624 - PURGEABLES[2]

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[5]	Completeness %[4]
Acrolein	40	D-170	95
Acrylonitrile	40	D-170	95
Benzene	9[6]	66-124[6]	95
Bromodichloromethane	16	52-142	95
Bromoform	10	68-100	95
Bromomethane	22	26-130	95
Carbon tetrachloride	15	58-158	95
Chlorobenzene	8[6]	82-118[6]	95
Chloroethane	20	30-132	95
2-Chloroethylvinyl ether	51	D- 74	95

TABLE 4-9 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 624 - PURGEABLES[2] (Continued)

Matrix: Water

Parameter	Precision %RSD[4]	Accuracy %R[5]	Completeness %[4]
Chloroform	19	45-167	95
Chloromethane	60	D-298	95
Dibromochloromethane	24	27-159	95
1,2-Dichlorobenzene	29[5]	18-190	95
1,3-Dichlorobenzene	16[5]	59-156	95
1,4-Dichlorobenzene	29[5]	18-190	95
1,1-Dichloroethane	45	D-260	95
1,2-Dichloroethane	40	D-247	95
1,1-Dichloroethene	10[6]	51-137[6]	95
trans-1,2-Dichloroethene	21	34-154	95
1,2-Dichloropropane	17	45-141	95
cis-1,3-Dichloropropene	26	15-117	95
trans-1,3-Dichloropropene	27	18-186	95
Ethylbenzene	33	D-225	95
Methylene chloride	12	88-178	95
1,1,2,2-Tetrachloroethane	20	34-148	95
Tetrachloroethene	19	59-173	95
Toluene	9[6]	63-129[6]	95
1,1,1-Trichloroethane	37	18-210	95
1,1,2-Trichloroethane	21	33-159	95
Trichloroethene	9[6]	62-134[6]	95
Trichlorofluoromethane	10	67-109	95
Vinyl chloride	42	D-153	95

TABLE 4-10 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 625 - BASE/NEUTRALS AND ACIDS[2]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	24	20-132	95
Acenaphthylene	21	28-124	95
Anthracene	30	9-151	95
Benzidine	45	D- 15	95
Benzo(a)anthracene	26	16-136	95
Benzo(b)fluoranthene	35	D-153	95
Benzo(k)fluoranthene	31	6-156	95
Benzo(g,h,i)perylene	27	14-124	95

TABLE 4-10 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 625 - BASE/NEUTRALS AND ACIDS[2] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzo(a)pyrene	28	12-132	95
Bis(2-Chloroethoxy)methane	22	7-135	95
Bis(2-Chloroethyl)ether	19	30-108	95
Bis(2-Chloroisopropyl)ether	18	43- 91	95
Bis(2-Ethylhexyl)phthalate	26	16-136	95
4-Bromophenyl phenyl ether	28	12- 96	95
Butyl benzyl phthalate	30	7-145	95
2-Chloronaphthalene	25	14-120	95
4-Chlorophenyl phenyl ether	24	20-122	95
Chrysene	26	21-159	95
Dibenzo(a,h)anthracene	32	2-132	95
Di-n-butyl phthalate	28	12-132	95
1,2-Dichlorobenzene	39	D-122	95
1,3-Dichlorobenzene	35	D-108	95
1,4-Dichlorobenzene	37	D-122	95
3,3'-Dichlorobenzidine	57	D- 57	95
Diethyl phthalate	42	D-123	95
Dimethyl phthalate	70	D-133	95
2,4-Dinitrotoluene	26	16-128	95
2,6-Dinitrotoluene	50	D-154	95
Di-n-octylphthalate	36	D-156	95
Fluoranthene	30	7-145	95
Fluorene	24	21-135	95
Hexachlorobenzene	29	10-154	95
Hexachlorobutadiene	36	D-132	95
Hexachlorocyclopentadiene	36	D- 37	95
Hexachloroethane	30	5-113	95
Indeno(1,2,3-cd)pyrene	24	19-115	95
Isophorone	30	8-152	95
Naphthalene	29	9-141	95
Nitrobenzene	23	24-126	95
N-Nitrosodimethylamine	47	D-144	95
N-Nitrosodiphenylamine	23	22-124	95
N-Nitrosodi-n-propylamine	21	27-117	95
Phenanthrene	27	15-153	95
Pyrene	24	24-150	95
1,2,4-Trichlorobenzene	25	D-128	95
4-Chloro-3-methylphenol	23	5-133	95
2-Chlorophenol	45	D-131	95
2,4-Dichlorophenol	17	31- 97	95

TABLE 4-10 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 625 - BASE/NEUTRALS AND ACIDS[2] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
2,4-Dimethylphenol	42	D-123	95
2,4-Dinitrophenol	23	16- 88	95
2-Methyl-4,6-dinitrophenol	37	D-122	95
2-Nitrophenol	23	18-102	95
4-Nitrophenol	22	21- 99	95
Pentachlorophenol	34	D-154	95
Phenol	30	7-151	95
2,4,6-Trichlorophenol	21	23-101	95

TABLE 4-11 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8010 - HALOGENATED VOLATILE ORGANICS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzyl chloride	20[4]	70-130[4]	95
Bromobenzene	20[4]	70-130[4]	95
Bromodichloromethane	20	42-172	95
Bromoform	28	13-159	95
Bromomethane	33	D-144	95
Carbon tetrachloride	18	43-143	95
Chlorobenzene	8[6]	73-119[6]	95
Chloroethane	17	46-137	95
Chloroform	15	49-133	95
1-Chlorohexane	20[4]	70-130[4]	95
2-Chloroethylvinyl ether	29	14-186	95
Chloromethane	33	D-193	95
Chlorotoluene	20	70-130[4]	95
Dibromochloromethane	26	24-191	95
Dibromomethane	20[4]	70-130[4]	95
1,2-Dichlorobenzene	33	D-208	95
1,3-Dichlorobenzene	31	7-187	95
1,4-Dichlorobenzene	18	42-143	95
Dichlorodifluoromethane	20[4]	70-130[4]	95
1,1-Dichloroethane	16	47-132	95
1,2-Dichloroethane	16	51-147	95
1,1-Dichloroethene	9[6]	67-115[6]	95
trans-1,2-Dichloroethene	20	38-155	95

TABLE 4-11 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8010 - HALGENATED VOLATILE ORGANICS[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Dichloromethane	24	25-162	95
1,2-Dichloropropane	19	44-156	95
trans-1,3-Dichloropropene	26	22-178	95
1,1,1,2-Tetrachloroethane	20[4]	70-130[4]	95
1,1,2,2-Tetrachloroethane	30	8-184	95
Tetrachloroethene	24	26-162	95
1,1,1-Trichloroethane	18	41-138	95
1,1,2-Trichloroethane	18	39-136	95
Trichloroethene	8[6]	72-122[6]	95
Trichlorofluoromethane	25	21-156	95
Trichloropropane	20[4]	70-130	95
Vinyl chloride	24	28-163	95

TABLE 4-12 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8010 - HALOGENATED VOLATILE ORGANICS[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzyl chloride	20[4]	70-130[4]	95
Bromobenzene	20[4]	70-130[4]	95
Bromodichloromethane	20	42-172	95
Bromoform	28	13-159	95
Bromomethane	33	D-144	95
Carbon tetrachloride	18	43-143	95
Chlorobenzene	8[6]	73-119[6]	95
Chloroethane	17	46-137	95
Chloroform	15	49-133	95
1-Chlorohexane	20[4]	70-130[4]	95
2-Chloroethylvinyl ether	29	14-186	95
Chloromethane	33	D-193	95
Chlorotoluene	20	70-130[4]	95
Dibromochloromethane	26	24-191	95
Dibromomethane	20[4]	70-130[4]	95
1,2-Dichlorobenzene	33	D-208	95
1,3-Dichlorobenzene	31	7-187	95
1,4-Dichlorobenzene	18	42-143	95
Dichlorodifluoromethane	20[4]	70-130[4]	95

TABLE 4-11 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8010 - HALGENATED VOLATILE ORGANICS[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
1,1-Dichloroethane	16	47-132	95
1,2-Dichloroethane	16	51-147	95
1,1-Dichloroethene	9[6]	67-115[6]	95
trans-1,2-Dichloroethene	20	38-155	95
Dichloromethane	24	25-162	95
1,2-Dichloropropane	19	44-156	95
trans-1,3-Dichloropropene	26	22-178	95
1,1,1,2-Tetrachloroethane	20[4]	70-130[4]	95
1,1,2,2-Tetrachloroethane	30	8-184	95
Tetrachloroethene	24	26-162	95
1,1,1-Trichloroethane	18	41-138	95
1,1,2-Trichloroethane	18	39-136	95
Trichloroethene	8[6]	72-122[6]	95
Trichlorofluoromethane	25	21-156	95
Trichloropropane	20[4]	70-130	95
Vinyl chloride	24	28-163	95

TABLE 4-13 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8020 - AROMATIC VOLATILE ORGANICS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzene	9[6]	68-120[6]	95
Chlorobenzene	9[6]	73-119[6]	95
1,2-Dichlorobenzene	20	37-154	95
1,3-Dichlorobenzene	16	50-141	95
1,4-Dichlorobenzene	18	42-143	95
Ethylbenzene	22	32-160	95
Toluene	9[6]	67-120[6]	95
Xylenes	10	70-124	95

TABLE 4-14 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8020 - AROMATIC VOLATILE ORGANICS[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Benzene	8[6]	72-119[6]	95
Chlorobenzene	8[6]	75-120[6]	95
1,2-Dichlorobenzene	20	37-154	95
1,3-Dichlorobenzene	16	50-141	95
1,4-Dichlorobenzene	18	42-143	95
Ethylbenzene	22	32-160	95
Toluene	8[6]	70-118[6]	95
Xylenes	10	70-124	95

TABLE 4-15 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8080 - ORGANOCHLORINE PESTICIDES AND PCBS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Aldrin	19[6]	24-135[6]	95
a-BHC	19	37-134	95
b-BHC	26	17-147	95
g-BHC (Lindane)	20[6]	30-150[6]	95
d-BHC	20	32-127	95
Chlordane	15	45-119	95
4,4'-DDD	21	31-141	95
4,4'-DDE	22	30-146	95
4,4'-DDT	22[6]	30-159[6]	95
Dieldrin	17[6]	40-141[6]	95
Endosulfan I	18	45-153	95
Endosulfan II	33	D-202	95
Endosulfan sulfate	23	26-144	95
Endrin	16[6]	48-145[6]	95
Endrin aldehyde	20[4]	30-147[4]	95
Heptachlor	19[6]	22-136[6]	95
Heptachlor epoxide	20	37-142	95
Methoxychlor	22[4]	53-159[4]	95
Toxaphene	17	41-126	95
PCB-1016	13	50-114	95
PCB-1221	32	15-178	95
PCB-1232	30	10-215	95
PCB-1242	20	39-150	95
PCB-1248	20	38-158	95

TABLE 4-15 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8080 - ORGANOCHLORINE PESTICIDES AND PCBS[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
PCB-1254	21	29-131	95
PCB-1260	29	8-127	95
PCB-1262	30[4]	8-127[4]	95

TABLE 4-16 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8080 - ORGANOCHLORINE PESTICIDES AND PCBS[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Aldrin	19[6]	22-134[6]	95
a-BHC	19	37-134	95
b-BHC	26	17-147	95
g-BHC (Lindane)	19[6]	29-141[6]	95
d-BHC	20	32-127	95
Chlordane	15	45-119	95
4,4'-DDD	21	31-141	95
4,4'-DDE	22	30-146	95
4,4'-DDT	19[6]	35-149[6]	95
Dieldrin	16[6]	43-137[6]	95
Endosulfan I	18	45-153	95
Endosulfan II	33	D-202	95
Endosulfan sulfate	23	26-144	95
Endrin	17[6]	40-139[6]	95
Endrin aldehyde	20[4]	30-147[4]	95
Heptachlor	17[6]	27-129[6]	95
Heptachlor epoxide	20	37-142	95
Methoxychlor	22[4]	53-159[4]	95
Toxaphene	17	41-126	95
PCB-1016	13	50-114	95
PCB-1221	32	15-178	95
PCB-1232	30	10-215	95
PCB-1242	20	39-150	95
PCB-1248	20	38-158	95
PCB-1254	21	29-131	95
PCB-1260	29	8-127	95
PCB-1262	30[4]	8-127[4]	95

TABLE 4-17 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8100 - POLYNUCLEAR AROMATIC HYDROCARBONS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	33	D-124	95
Acenaphthylene	33	D-139	95
Anthracene	33	D-126	95
Benzo(a)anthracene	28	12-135	95
Benzo(b)fluoranthene	31	6-150	95
Benzo(k)fluoranthene	33	D-159	95
Benzo(g,h,i)perylene	33	D-116	95
Benzo(a)pyrene	33	D-128	95
Chrysene	33	D-199	95
Dibenzo(a,h)anthracene	33	D-110	95
Fluoranthene	26	14-123	95
Fluorene	33	D-142	95
Indeno(1,2,3-cd)pyrene	33	D-116	95
1-Methylnaphthalene	33	D-122[4]	95
2-Methylnaphthalene	33	D-122[4]	95
Naphthalene	33	D-122	95
Phenanthrene	33	D-155	95
Pyrene	33	D-140	95

TABLE 4-18 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8100 - POLYNUCLEAR AROMATIC HYDROCARBONS[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	33	D-124	95
Acenaphthylene	33	D-139	95
Anthracene	33	D-126	95
Benzo(a)anthracene	28	12-135	95
Benzo(b)fluoranthene	31	6-150	95
Benzo(k)fluoranthene	33	D-159	95
Benzo(g,h,i)perylene	33	D-116	95
Benzo(a)pyrene	33	D-128	95
Chrysene	33	D-199	95
Dibenzo(a,h)anthracene	33	D-110	95
Fluoranthene	26	14-123	95
Fluorene	33	D-142	95
Indeno(1,2,3-cd)pyrene	33	D-116	95

TABLE 4-18 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8100 - POLYNUCLEAR AROMATIC HYDROCARBONS[3] (Continued)

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
1-Methylnaphthalene	33	D-122[4]	95
2-Methylnaphthalene	33	D-122[4]	95
Naphthalene	33	D-122	95
Phenanthrene	33	D-155	95
Pyrene	33	D-140	95

TABLE 4-19 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8150 - CHLORINATED PHENOXY ACID HERBICIDES[3]

Matrix: Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
2,4-D	20	25-142	95
2,4,5-T	29	25-142	95
2,4,5-TP (Silvex)	19	25-142	95

TABLE 4-20 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8150 - CHLORINATED PHENOXY ACID HERBICIDES[3]

Matrix: Solid

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
2,4-D	20	23-108	95
2,4,5-T	18	23-108	95
2,4,5-TP (Silvex)	20	23-108	95

TABLE 4-21 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8240 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acetone	30[4]	70-130[4]	95
Acrolein	40[4]	D-170[4]	95
Acrylonitrile	40[4]	D-170[4]	95
Benzene	9[6]	66-124[6]	95
Bromodichloromethane	20	35-155	95
Bromoform	21	45-169	95
Bromomethane	33	D-242	95
2-Butanone	30[4]	70-130[4]	95
Carbon disulfide	30[4]	70-130[4]	95
Carbon tetrachloride	12	70-140	95
Chlorobenzene	8[6]	82-118[6]	95
Chloroethane	36	14-230	95
2-Chloroethylvinyl ether	51	D-305	95
Chloroform	14	51-138	95
Chloromethane	46	D-273	95
Dibromochloromethane	16	53-149	95
1,2-Dichlorobenzene	29	18-190	95
1,3-Dichlorobenzene	16	59-156	95
1,4-Dichlorobenzene	29	18-190	95
1,1-Dichloroethane	16	59-155	95
1,2-Dichloroethane	18	49-155	95
1,1-Dichloroethene	10[6]	51-137[6]	95
trans-1,2-Dichloroethene	17	54-156	95
1,2-Dichloropropane	35	D-210	95
cis-1,3-Dichloropropene	36	D-227	95
trans-1,3-Dichloropropene	28	17-183	95
Ethylbenzene	21	37-162	95
2-Hexanone	30[4]	70-130[4]	95
4-Methyl-2-pentanone	30[4]	70-130[4]	95
Methylene chloride	37	D-221	95
Styrene	30[4]	70-130[4]	95
1,1,2,2-Tetrachloroethane	18	46-157	95
Tetrachloroethene	14	64-148	95
Toluene	9[6]	63-129[6]	95
1,1,1-Trichloroethane	18	52-162	95
1,1,2-Trichloroethane	16	52-150	95
Trichloroethene	9[6]	62-134[6]	95

TABLE 4-21 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8240 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Trichlorofluoromethane	27	17-181	95
Vinyl acetate	30[4]	70-130[4]	95
Vinyl chloride	42	D-251	95
Total xylenes	30[4]	70-130[4]	95

TABLE 4-22 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8240 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acetone	30[4]	70-130[4]	95
Acrolein	40[4]	D-170[4]	95
Acrylonitrile	40[4]	D-170[4]	95
Benzene	9[6]	73-129[6]	95
Bromodichloromethane	20	35-155	95
Bromoform	21	45-169	95
Bromomethane	40	D-242	95
2-Butanone	30[4]	70-130[4]	95
Carbon disulfide	30[4]	70-130[4]	95
Carbon tetrachloride	12	70-140	95
Chlorobenzene	8[6]	77-121[6]	95
Chloroethane	36	14-230	95
2-Chloroethylvinyl ether	51	D-305	95
Chloroform	14	51-138	95
Chloromethane	46	D-273	95
Dibromochloromethane	16	53-149	95
1,2-Dichlorobenzene	29	18-190	95
1,3-Dichlorobenzene	16	59-156	95
1,4-Dichlorobenzene	29	18-190	95
1,1-Dichloroethane	16	59-155	95
1,2-Dichloroethane	18	49-155	95
1,1-Dichloroethene	10[6]	51-151[6]	95
trans-1,2-Dichloroethene	17	54-156	95
1,2-Dichloropropane	35	D-210	95
cis-1,3-Dichloropropene	38	D-227	95
trans-1,3-Dichloropropene	28	17-183	95
Ethylbenzene	21	37-162	95

TABLE 4-22 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8240 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR VOLATILE ORGANICS[3]
(Continued)

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
2-Hexanone	30[4]	70-130[4]	95
4-Methyl-2-pentanone	30[4]	70-130[4]	95
Methylene chloride	37	D-221	95
Styrene	30[4]	70-130[4]	95
1,1,2,2-Tetrachloroethane	18	46-157	95
Tetrachloroethene	14	64-148	95
Toluene	9[6]	67-127[6]	95
1,1,1-Trichloroethane	18	52-162	95
1,1,2-Trichloroethane	16	52-150	95
Trichloroethene	9[6]	52-146[6]	95
Trichlorofluoromethane	27	17-181	95
Vinyl acetate	30[4]	70-130[4]	95
Vinyl chloride	42	D-251	95
Total xylenes	30[4]	70-130[4]	95

TABLE 4-23 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3]

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	17[6]	25-127[6]	95
Acenaphthylene	19	33-145	95
Anthracene	18	27-133	95
Benzidine	45	D- 15	95
Benzo(a)anthracene	18	33-143	95
Benzo(b)fluoranthene	23	24-159	95
Benzo(k)fluoranthene	25	11-162	95
Benzo(g,h,i)perylene	36	D-219	95
Benzo(a)pyrene	24	17-163	95
Benzyl alcohol	30[4]	50-150[4]	95
Bis(2-Chloroethoxy)methane	25	33-184	95
Bis(2-Chloroethyl)ether	24	12-158	95
Bis(2-Chloroisopropyl)ether	22	36-166	95
Bis(2-Ethylhexyl)phthalate	25	8-158	95
4-Bromophenyl phenyl ether	12	53-127	95

TABLE 4-23 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Butyl benzyl phthalate	50[4]	D-152	95
2-Chloronaphthalene	10	60-118	95
4-Chlorophenyl phenyl ether	22	25-158	95
Chrysene	25	17-168	95
Dibenzo(a,h)anthracene	38	D-227	95
Di-n-butyl phthalate	20	1-118	95
1,2-Dichlorobenzene	16	32-129	95
1,3-Dichlorobenzene	29	D-172	95
1,4-Dichlorobenzene	15[6]	15-103[6]	95
3,3'-Dichlorobenzidine	44	D-262	95
Diethyl phthalate	50[4]	D-114	95
Dimethyl phthalate	50[4]	D-112	95
2,4-Dinitrotoluene	21[6]	16-145[6]	95
2,6-Dinitrotoluene	18	50-158	95
Di-n-octylphthalate	24	4-146	95
Fluoranthene	18	26-137	95
Fluorene	10	59-121	95
Hexachlorobenzene	25	D-152	95
Hexachlorobutadiene	15	24-116	95
Hexachlorocyclopentadiene	36	D- 37	95
Hexachloroethane	12	40-113	95
Indeno(1,2,3-cd)pyrene	29	D-171	95
Isophorone	29	21-196	95
2-Methylnaphthalene	30[4]	50-150[4]	95
Naphthalene	19	21-133	95
2-Nitroaniline	30[4]	50-150[4]	95
3-Nitroaniline	30[4]	50-150[4]	95
4-Nitroaniline	30[4]	50-150[4]	95
Nitrobenzene	26	25-180	95
N-Nitrosodimethylamine	47	D-144	95
N-Nitrosodiphenylamine	23	22-124	95
N-Nitrosodi-n-propylamine	16[6]	22-119[6]	95
Phenanthrene	11	54-120	95
Pyrene	34[6]	D-202[6]	95
1,2,4-Trichlorobenzene	19[6]	19-103[6]	95
Benzoic acid	30[4]	50-150[4]	95
4-Chloro-3-methylphenol	28[6]	D-160[6]	95
2-Chlorophenol	34[6]	D-177[6]	95
2,4-Dichlorophenol	16	39-135	95

TABLE 4-23 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
2,4-Dimethylphenol	14	32-119	95
2,4-Dinitrophenol	32	D-191	95
2-Methyl-4,6-dinitrophenol	30	D-181	95
2-Methylphenol	30[4]	50-150[4]	95
4-Methylphenol	30[4]	50-150[4]	95
2-Nitrophenol	26	29-182	95
4-Nitrophenol	31[6]	D-168[6]	95
Pentachlorophenol	22[6]	8-140[6]	95
Phenol	18[6]	12-119[6]	95
2,4,5-Trichlorophenol	30[4]	50-150[4]	95
2,4,6-Trichlorophenol	18	37-144	95

TABLE 4-24 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3]

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Acenaphthene	12[6]	35-109[6]	95
Acenaphthylene	19	33-145	95
Anthracene	18	27-133	95
Benzidine	45	D- 15	95
Benzo(a)anthracene	18	33-143	95
Benzo(b)fluoranthene	23	24-159	95
Benzo(k)fluoranthene	25	11-162	95
Benzo(g,h,i)perylene	36	D-219	95
Benzo(a)pyrene	24	17-163	95
Benzyl alcohol	30[4]	50-150[4]	95
Bis(2-Chloroethoxy)methane	25	33-184	95
Bis(2-Chloroethyl)ether	24	12-158	95
Bis(2-Chloroisopropyl)ether	22	36-166	95
Bis(2-Ethylhexyl)phthalate	25	8-158	95
4-Bromophenyl phenyl ether	12	53-127	95
Butyl benzyl phthalate	50[4]	D-152	95
2-Chloronaphthalene	10	60-118	95
4-Chlorophenyl phenyl ether	22	25-158	95

TABLE 4-24 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3] (Continued)

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
Chrysene	25	17-168	95
Dibenzo(a,h)anthracene	38	D-227	95
Di-n-butyl phthalate	20	1-118	95
1,2-Dichlorobenzene	16	32-129	95
1,3-Dichlorobenzene	29	D-172	95
1,4-Dichlorobenzene	13[6]	14- 94[6]	95
3,3'-Dichlorobenzidine	44	D-262	95
Diethyl phthalate	50[4]	D-114	95
Dimethyl phthalate	50[4]	D-112	95
2,4-Dinitrotoluene	17[6]	19-123	95
2,6-Dinitrotoluene	18	50-158	95
Di-n-octylphthalate	24	4-146	95
Fluoranthene	18	26-137	95
Fluorene	10	59-121	95
Hexachlorobenzene	25	D-152	95
Hexachlorobutadiene	15	24-116	95
Hexachlorocyclopentadiene	36	D- 37	95
Hexachloroethane	12	40-113	95
Indeno(1,2,3-cd)pyrene	29	D-171	95
Isophorone	29	21-196	95
2-Methylnaphthalene	30[4]	50-150[4]	95
Naphthalene	19	21-133	95
2-Nitroaniline	30[4]	50-150[4]	95
3-Nitroaniline	30[4]	50-150[4]	95
4-Nitroaniline	30[4]	50-150[4]	95
Nitrobenzene	26	25-180	95
N-Nitrosodimethylamine	47	D-144	95
N-Nitrosodiphenylamine	23	22-124	95
N-Nitrosodi-n-propylamine	12[6]	31-102[6]	95
Phenanthrene	11	54-120	95
Pyrene	27[6]	9-172[6]	95
1,2,4-Trichlorobenzene	12[6]	23- 95[6]	95
Benzoic acid	30[4]	50-150[4]	95
4-Chloro-3-methylphenol	30[6]	D-166[6]	95
2-Chlorophenol	14[6]	16-100[6]	95
2,4-Dichlorophenol	16	39-135	95
2,4-Dimethylphenol	14	32-119	95
2,4-Dinitrophenol	32	D-191	95
2-Methyl-4,6-dinitrophenol	30	D-181	95

TABLE 4-24 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 8270 - GAS CHROMATOGRAPHY/MASS SPECTROMETRY FOR SEMIVOLATILE ORGANICS:
CAPILLARY COLUMN TECHNIQUE[3] (Continued)

Matrix: Solid

Parameter	Precision %RSD[5]	Accuracy %R[5]	Completeness %[4]
2-Methylphenol	30[4]	50-150[4]	95
4-Methylphenol	30[4]	50-150[4]	95
2-Nitrophenol	26	29-182	95
4-Nitrophenol	23[6]	D-135[6]	95
Pentachlorophenol	25[6]	4-153[6]	95
Phenol	16[6]	14-113[6]	95
2,4,5-Trichlorophenol	30[4]	50-150[4]	95
2,4,6-Trichlorophenol	18	37-144	95

TABLE 4-25 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS ORGANIC COMPOUNDS

Matrix: Water

Parameter	Method	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
1,2-Dibromoethane(EDB)	601(mod)[7,2]	10	83-133	95
1,2-Dibromoethane(EDB)	8010(mod)[7,2]	10	83-133	95
1-Methylnaphthalene	625[2]	29	91-141	95
1-Methylnaphthalene	8270[3]	19	21-133	95
2-Methylnaphthalene	625[2]	29	9-141	95
2-Methylnaphthalene	8270[3]	29	9-141	95
Methyl tert-butyl ether	602[2]	10	74-108	95
Methyl tert-butyl ether	8020[2]	10	74-108	95
Xylenes (Total)	602[2]	10	70-124	95

TABLE 4-26 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS ORGANIC COMPOUNDS

Matrix: Solid

Parameter	Method	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
1,2-Dibromoethane(EDB)	8010(mod)[7,2]	10	83-133	95
1-Methylnaphthalene	8270[3]	19	21-133	95
2-Methylnaphthalene	8270[3]	29	9-141	95
Methyl tert-butyl ether	8020[2]	10	74-108	95

TABLE 4-27 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 200.7 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRIC METHOD FOR TRACE ELEMENT ANALYSIS OF WATER AND WASTES[8]

Matrix: Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Aluminum	30	72-127	95
Antimony	15	24-124	95
Barium	14	63-115	95
Beryllium	12	68-107	95
Boron	13	50-124	95
Cadmium	9	73-110	95
Calcium	25	73-119	95
Chromium	18	75-104	95
Cobalt	14	75-109	95
Copper	17	75-104	95
Iron	18	65-115	95
Lead	15	64-112	95
Magnesium	25	68-120	95
Manganese	24	62-121	95
Molybdenum	17	77-115	95
Nickel	11	70-107	95
Potassium	40	60-133	95
Silicon	11	83-111	95
Silver	26	61-108	95
Sodium	30	65-123	95
Strontium	10	81-114	95
Thallium	13	68-108	95
Tin	13	66-125	95
Titanium	18	55-125	95
Tungsten	10	73-115	95
Vanadium	13	71-111	95
Zinc	21	63-113	95

TABLE 4-28 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 200.7 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRIC METHOD FOR TRACE ELEMENT ANALYSIS OF WATER AND WASTES[8]

Matrix: Drinking Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Barium	14	90-106	95
Calcium	25	73-119	95
Copper	17	75-104	95
Iron	18	65-115	95
Magnesium	25	68-120	95
Manganese	24	62-121	95
Sodium	30	65-123	95
Zinc	21	63-113	95

TABLE 4-29 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 6010 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY[3]

Matrix: Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Aluminum	30	72-127	95
Antimony	15	24-124	95
Barium	14	63-115	95
Beryllium	12	68-107	95
Boron	13	50-124	95
Cadmium	9	73-110	95
Calcium	25	73-119	95
Chromium	18	75-104	95
Cobalt	14	71-109	95
Copper	17	75-104	95
Iron	18	65-115	95
Lead	15	64-112	95
Magnesium	25	68-120	95
Manganese	24	62-121	95
Molybdenum	17	77-115	95
Nickel	11	70-107	95
Potassium	40	60-133	95
Silicon	11	83-111	95
Silver	26	61-108	95
Sodium	30	65-123	95
Strontium	10	81-114	95

TABLE 4-29 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 6010 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY[3] (Continued)

Matrix: Water

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Thallium	13	68-108	95
Tin	13	66-125	95
Titanium	18	55-125	95
Tungsten	10	73-115	95
Vanadium	13	71-111	95
Zinc	21	63-113	95

TABLE 4-30 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 6010 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY[3]

Matrix: Solid

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Aluminum	30	59-140	95
Antimony	15	24-124	95
Barium	14	51-128	95
Beryllium	12	59-116	95
Boron	13	31-142	95
Cadmium	9	66-108	95
Calcium	25	62-130	95
Chromium	18	67-111	95
Cobalt	14	61-118	95
Copper	17	68-111	95
Iron	18	52-127	95
Lead	15	52-124	95
Magnesium	25	55-133	95
Manganese	24	47-136	95
Molybdenum	17	68-125	95
Nickel	11	61-116	95
Potassium	40	42-151	95
Silicon	11	76-118	95
Silver	26	50-120	95
Sodium	30	51-137	95
Strontium	10	73-122	95
Thallium	13	58-118	95

TABLE 4-30 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
METHOD 6010 - INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROSCOPY[3] (Continued)

Matrix: Solid

Parameter	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Tin	13	51-139	95
Titanium	18	55-125	95
Tungsten	10	62-125	95
Vanadium	13	61-121	95
Zinc	21	51-126	95

TABLE 4-31 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS METALS

Matrix: Water

Parameter	Method	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Antimony	204.2[8]	20	75-125	95
Antimony	7041[3]	20	75-125	95
Arsenic	206.2[8]	34[6]	55-123[6]	95
Arsenic	7060[3]	34[6]	55-123[6]	95
Cadmium	213.2[8]	20	75-125	95
Cadmium	7131[3]	20	75-125	95
Chromium	218.2[8]	20	75-125	95
Chromium	7191[3]	20	75-125	95
Copper	220.2[8]	20	75-125	95
Lead	239.2[8]	20	75-125	95
Lead	7421[3]	20	75-125	95
Mercury	245.1[8]	27[6]	67-142[6]	95
Mercury	7470[3]	27[6]	67-142[6]	95
Selenium	270.2[8]	30[6]	28-121[6]	95
Selenium	7740[3]	30[6]	28-121[6]	95
Thallium	279.2[8]	20	75-125	95
Thallium	7841[3]	20	75-125	95

TABLE 4-32 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS METALS

Matrix: Drinking Water

Parameter	Method[5]	Precision %RSD[4]	Accuracy %R[6]	Completeness %[4]
Arsenic	206.2	34[6]	80-118	95
Cadmium	213.2	20	66-129	95
Chromium	218.2	20	84-122	95
Lead	239.2	20	82-123	95
Mercury	245.1	27[6]	67-142	95
Selenium	270.2	30[6]	71-112	95
Silver	272.2	20	79-118	95

TABLE 4-33 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS METALS

Matrix: Solid

Parameter	Method[3]	Precision %RSD[4]	Accuracy %R[4]	Completeness %[4]
Antimony	7041	20	75-125	95
Arsenic	7060	34[6]	38-140[6]	95
Cadmium	7131	20	75-125	95
Chromium	7191	20	75-125	95
Lead	7421	20	75-125	95
Mercury	7470	27[6]	50-161[6]	95
Mercury	7471	27[6]	50-161[6]	95
Selenium	7740	30[6]	28-121[6]	95
Thallium	7841	20	75-125	95

TABLE 4-34 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS WET CHEMISTRY PARAMETERS

Matrix: Water

Parameter	Method	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Acidity	305.2[8]	16	73-119	95
Alkalinity	310.1[8]	17	85-110	95
Ammonia Nitrogen	350.2[8]	20	77-127	95
Bromide	WAL ISE	22	80-122	95
Chemical Oxygen Demand	508B[12]	21	71-129	95
Chloride	325.2[8]	8	94-119	95

TABLE 4-34 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS WET CHEMISTRY PARAMETERS (Continued)

Matrix: Water

Parameter	Method	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Chloride	9250[3]	8	94-119	95
Chloride-Potable Water	325.2[8]	9	87-126	95
Chromium (Hexavalent)	307B[13]	18	75-116	95
Chromium (Hexavalent)	7195[3]	18	75-116	95
Cyanide	335.2[8]	33	48-116	95
Cyanide	9010[3]	33	48-116	95
Fluoride	340.2[8]	20	77-131	95
Fluoride	314B[12]	20	77-131	95
Hardness	130.2[8]	30	81-120	95
Methylene Blue Active Substances	425.1[8]	24	72-125	95
Nitrate Nitrogen	353.3[8]	7	67-118	95
Nitrate Nitrogen	9200[3]	7	67-118	95
Nitrate-Potable Water	353.2[8]	7	81-107	95
Nitrate-Potable Water	418C[12]	7	81-107	95
Nitrite Nitrogen	353.3[8]	13	77-119	95
pH	150.1[8]	±0.1 units[4]	±0.2 units[4]	95
pH	9040[3]	±0.1 units[4]	±0.2 units[4]	95
Phenols	420.1[8]	14	50-126	95
Phosphate	365.2[8]	33	50-141	95
Residue				
Filterable	160.1[8]	16	55-151	95
Non-Filterable	160.2[8]	20[4]	80-120[4]	95
Settleable	160.5[8]	[20]4	80-120[4]	95
Total	160.3[8]	20[4]	80-120[4]	95
Volatile	160.4[8]	20[4]	70-130[4]	95
Specific Conductance	120.1[8]	±0.1 umhos[4]	±0.2 umhos[4]	95
Sulfate	375.4[8]	15	77-117	95
Sulfate	9035[3]	15	77-117	95
Sulfide	376.1[8]	14	46-117	95
Sulfide	9030[3]	14	46-117	95
Sulfite	377.1[8]	10	61-116	95
Tot Recoverable Pet Hydrocarbons	418.1[8]	30	51-158	95
Total Kjeldahl Nitrogen	351.3[8]	20	79-114	95

TABLE 4-34 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS WET CHEMISTRY PARAMETERS (Continued)

Matrix: Water

Parameter	Method	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Total Organic Carbon	415.1[8]	14	78-123	95
Total Organic Carbon	9060[3]	14	78-123	95
Total Organic Halogen	450.1[8]	40	50-117	95
Total Organic Halogen	9020[3]	40	50-117	95
Total Organic Nitrogen	351.3[8]	27	78-118	95

TABLE 4-35 PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES
MISCELLANEOUS WET CHEMISTRY PARAMETERS

Matrix: Solid

Parameter	Method	Precision %RSD[6]	Accuracy %R[6]	Completeness %[4]
Ammonia Nitrogen	350.2[8]	20	65-139	95
Chloride	9250[3]	8	88-125	95
Chromium (Hexavalent)	7195[3]	18	64-127	95
Cyanide	9010[3]	33	48-116	95
Nitrate Nitrogen	9200[3]	7	55-130	95
pH	9040[3]	±0.1 units[4]	±0.2 units[4]	95
Phenolics, Total	420.1[8]	14	31-145	95
Phosphorus, All Forms	365.2[8]	33	27-164	95
Sulfate	9035[3]	15	67-127	95
Sulfide	9030[3]	14	46-117	95
Tot Recoverable Pet Hydrocarbons	418.1[8]	30	27-144	95
Total Kjeldahl Nitrogen	351.3[8]	20	70-123	95
Total Organic Nitrogen	351.3[9]	27	68-128	95

PRECISION, ACCURACY, AND COMPLETENESS OBJECTIVES NOTATIONS

1. Taylor, J.K, Quality Assurance of Chemical Measurements, Lewis Publishers, Inc. Chelsea, Michigan (1987).

2. 40 CFR Part 136, Appendix A, October 26, 1984.

3. SW846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, EPA, September 1986.

4. Advisory limit - Refer to Chapter 4.0 for the laboratory definition.

5. EPA method control data

6. In-house data

7. Method modification: EC detector is substituted for the Hall detector.

8. EPA Methods for Chemical Analysis of Water and Wastes 1983, EPA 600/4-79-020

9. No objectives necessary - method is for screening only.

10. Analysis of Trihalomethanes in Drinking Water, November 29, 1979, EPA 600/D-80-020.

11. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water, September 1986.

12. Standard Methods for the Examination of Water and Wastewater, Sixteenth Edition.

13. Standard Methods for the Examination of Water and Wastewater, Fourteen Edition.

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5.0 SAMPLING PROCEDURES

5.1 Sample Collection Procedures

Wadsworth/ALERT Laboratories uses USEPA-approved and/or proposed sample collection methods and equipment outlined in the following technical publications:

- EPA/SW846, "Test Methods for Evaluating Solid Waste Physical/ Chemical Methods," Third Edition, USEPA, 1986.
- EPA/600/2-80-018, "Samples and Sampling Procedures for Hazardous Waste Streams".
- EPA 600/4-84-076, "Characterization of Hazardous Waste Sites - A Methods Manual, Volume II: Available Sampling Methods," December 1984.
- U.S. Army Corps of Engineers, "Interim Standard Air Monitoring Guide for Hazardous Waste Sites," June 1984.
- EPA/SW611, "Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities".
- EPA 600/4-83-020, "Preparation of Solid Sampling Protocol: Techniques and Strategies," May 1983.
- EPA 600/4-82-029, "Handbook for Sampling and Sample Preservation of Water and Wastewater," September 1982.
- EPA Region IV Engineering Support Branch, "Standard Operating Procedures and Quality Assurance Manual," April 1986.

Specific guidelines for a project for sample site selection, selection of sampling equipment, types of samples to be collected, standard sample collection procedures, specific maintenance and calibration procedures for sampling equipment, and other considerations are based upon site-specific requirements.

5.2 Selection and Preparation of Sampling Equipment

The material of which sampling equipment is constructed can affect analytical results. The material selected for sampling certain parameters must not contaminate or alter the sample being collected, and must be easily cleaned so that samples are not cross-contaminated. Also, the action of the sampling device must not alter the sample being collected (e.g., using an air-lift pump for volatiles in water may purge the compounds of interest).

Wadsworth/ALERT sampling personnel select equipment based upon the medium and parameters being sampled following the guidance documents listed in Chapter 5.1. All sampling equipment is prepared following the specifications of the guidance documents in Chapter 5.1. Any deviation from standard procedures must be documented and reported to the Sample Procurement Manager.

5.3 Sample Containers, Preservations, and Holding Times

Wadsworth/ALERT Laboratories recognize that proper containers and appropriate preservatives are necessary for the collection of valid samples. In addition, the sample must be analyzed within a prescribed time frame for each parameter. The Laboratory Sample Preservation Summary (Tables 5-1 and 5-2) details permissible sample containers, preservatives, holding times, and minimum volume of sample needed. The requirements of these tables correspond with the guidelines of the documents listed in Chapter 5.1.

5.4 Sample Documentation

Wadsworth/ALERT Laboratories uses proper sample documentation measures to record pertinent field data and ensures the legal validity of all collected samples. These sample documentation measures provide a detailed, legal record of all sampling activities including: sample collection, preservation, chain-of-custody possession, transportation, and laboratory submittal. Key component sample documentation measures include use of the following record materials: Laboratory Field Sample Logbooks, Sample Labels, Sample Seals, Chain-of-Custody Forms, and Laboratory Sample Log. These are described in Chapter 6, Sample Custody.

5.5 Sample Collection Quality Control Procedures

5.5.1 Experience Requirements

All Wadsworth/ALERT Laboratories field personnel must have at least six weeks field experience before conducting sampling programs without supervision. Each new field employee accompanies a qualified trainer on different types of field studies. During this training period, the employee receives instruction in sample site selection and preparation of equipment and materials, sample collection for various media, preservation, documentation, packing, and shipment.

5.5.2 Traceability Requirements

All sample collection activities are traceable, through field records, to the person collecting the sample and to the specific piece of sampling equipment used to collect that sample (where appropriate). In a similar fashion, all maintenance and calibration records for sampling equipment are kept so that they, too, are traceable.

5.5.3 Measurement of Sample Container and Sample Equipment Integrity

Only containers that have been properly prepared for specific types of samples are used for sample collection. To ensure the integrity of containers for volatile organic compounds, a representative container is filled with deionized water, preserved, carried into the field, and returned. VOC analysis is then performed. This quality assurance procedure is performed at least once per sampling event.

Preserved volatile organic compound (VOC) blanks are supplied for each investigation where VOCs are collected. These blanks are carried into the field, treated as regular VOC samples, and submitted for VOC analysis along with the required samples.

The sampler logs all sample container, preservative, and sample equipment blank data on field logsheets. Any problems noted with specific equipment, preservatives, or personnel are promptly reported to the Sample Procurement Manager so that corrective action can be instituted.

5.5.4 Measurement of Relative Sampling Precision

The following duplicate sampling procedures are used during the collection of samples to measure the precision of the sample collection process:

- Duplicate grab and composite samples for solids are collected during all investigations and studies conducted by Wadsworth/ALERT Laboratories when a client requests this procedure or any time when there are 15 or more samples. At a minimum, five percent of all solid samples are collected at the same time, use the same procedures, equipment,

and containers as the required samples. They are also preserved in the same manner and submitted for the same analyses as the required samples. Duplicate sample data are reported to the Quality Control Manager or his/her designee.

- The resulting data is periodically examined to determine if any problems are evident with specific types of media samples or with the procedures used by specific sampling personnel. The Technical Director is advised of any such problems so that corrective action may be taken as needed (Chapter 13).

5.6 Sample Transportation and Shipment

Samples are delivered to the Laboratory for analysis as soon as practical (1 to 2 days after collection). The samples are properly preserved, packaged for transport, and accompanied by chain-of-custody documentation prior to shipment or transport to the Laboratory. The samples are also submitted to the designated Sample Custodian for proper acceptance into the Laboratory.

5.6.1 Non-Hazardous Samples

Environmental samples are transported and/or shipped in the Laboratory's transport shippers or coolers. The shippers are designed and used exclusively by the Laboratory and are provided upon request to clients conducting their own sampling operations.

Laboratory transport shippers are 16" x 24" x 12" high-density polyethylene (HDPE) heavy transit cases form-fitted with high-density insulating foam. Each shipper contains packaging instructions, appropriate sample containers and preservatives, ice packs for refrigeration, various Laboratory sample documentation materials and Laboratory sample seals. Laboratory transport shippers are delivered or shipped via overnight carrier to the laboratory as soon as practical after collection.

5.6.2 Hazardous Samples

Hazardous samples as indicated in the DOT Hazardous Material Table (49 CFR 172.101) are transported as specified in the regulations. Other potentially hazardous material samples are packaged and shipped as follows:

- Samples are placed in 32 oz. glass jars with TFE-lined lids or polyethylene bottles, as appropriate. All filled containers have sufficient air-space to allow for sample expansion and for volatilization. Samples to be analyzed for low level volatile organics are placed in 40 ml vials (no headspace) with appropriate septum lids.

- Sample containers are inserted and sealed in a four (4) mil thick polyethylene zip-lock bag. (1 container/bag)

- Bagged containers are placed inside a 1 gallon metal paint can. Inert packing material (e.g. vermiculite) is then placed into the can to prevent breakage. The can is sealed and locked with lid clips.

- The can is placed in a DOT-12B fiberboard box or equivalent and sealed.

- The sealed box is labeled in accordance with DOT specifications (see 49 CFR 172.101).

5.6.3 Hazardous Materials Regulations (49 CFR Part 172)

The party offering hazardous material for transportation is responsible for ensuring compliance. The Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid in water solutions at concentrations of 0.04% by weight or less (pH approximately 1.96 or greater); Nitric acid in water solutions at concentrations of 0.15% by weight or less (pH approximately 1.62 or greater); Sulfuric acid in

water solutions at concentrations of 0.35% by weight or less (pH approximately 1.15 or greater); and Sodium hydroxide in water solutions at concentrations of 0.08% by weight or less (pH approximately 12.30 or less). These are the solutions used for preservation of samples.

The Laboratory uses UPS or Federal Express to ship bottles or samples. Clients may pick up sample containers at the Laboratory's Sample Receiving Office. The Laboratory receives daily shipments of samples through UPS, Federal Express, and Purolator Courier. Clients also may deliver their own samples to Sample Receiving. All bottles are shipped with instructions on sampling and preservation procedures as well as the preservatives required.

References:

- Handbook for Sampling and Sample Preservation of Water and Wastewater, EPA 600/4-82-029, September 1982.

- SW846, Third Edition, September 1986.

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

Parameter	Container[1]	Preservative[2,10]	Recommended Holding Time[3]	Amount of Sample Required
Bacteriological				
Coliform, Fecal and Total	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	6 hours	250 ml
Metals				
Chromium VI[4]	P,G	Cool, 4°C	24 hours	250 ml
Mercury	P,G	HNO_3 to pH <2	28 days	250 ml
Metals, except above[4]	P,G	HNO_3 to pH <2	6 months	1 l
Organics[5]				
Base Neutral Acid Extractables (GC/MS)	G, TFE Lined Cap	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	7 days until extraction, 40 days after extraction	1 l
Polynuclear Aromatic Hydrocarbons	G, TFE Lined Cap	Cool, 4°C 0.008% $Na_2S_2O_3$[6] Store in Dark	7 days until extraction, 40 days after extraction	1 l
Pesticides/PCBs	G, TFE Lined Cap	Cool, 4°C pH 5-9[7] Store in Dark	7 days until extraction, 40 days after extraction	1 l

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

Parameter	Container[1]	Preservative[2,10]	Recommended Holding Time[3]	Amount of Sample Required
Purgeable Halocarbons (EPA 601,501.1)	G, TFE Lined Septum	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	14 days	3 x 40 ml
Purgeable Aromatics (EPA 602,624, 502.2)	G, TFE Lined Septum	Cool, 4°C HCl to pH <2[8] 0.008% $Na_2S_2O_3$[6]	14 days	3 x 40 ml
Volatile Organics[9] (SW 8010, 8020, 8240)				
No Residual Chlorine	G, TFE Lined Septum	Cool, 4°C 4 drops Conc. HCl	14 days	3 x 40 ml
Residual Chlorine	G, TFE Lined Septum	Collect Sample in a 250 ml VOA Container Preserved with 4 drops of 10% $Na_2S_2O_3$[6]. Mix and Transfer to 40 ml Vials Preserved with 4 drops Conc. HCl, Cool, 4°C	14 days	3 x 40 ml
Total Petroleum Hydrocarbons (GC)	P,G	Cool, 4°C	28 days	2 l
Physical Properties				
Acidity	P,G	Cool, 4°C	14 days	250 ml
Alkalinity	P,G	Cool, 4°C	14 days	250 ml
Biochemical Oxygen Demand	P,G	Cool, 4°C	48 hours	250 ml
Biochemical Oxygen Demand, Carbonaceous	P,G	Cool, 4°C	48 hours	250 ml

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

Parameter	Container[1]	Preservative[2,10]	Recommended Holding Time[3]	Amount of Sample Required
Bromide	P,G	None Required	28 days	250 ml
Carbon, Total Organic	G	Cool, 4°C H_2SO_4 to pH <2	28 days	4 x 40 ml
Chemical Oxygen Demand	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	250 ml
Chloride	P,G	None Required	28 days	250 ml
Chlorine, Total Residual	P,G	None Required	Analyze Immediately	250 ml
Color	P,G	Cool, 4°C	48 hours	500 ml
Conductivity (Specific Conductance)	P,G	Cool, 4°C	28 days	100 ml
Cyanide, Total and Amenable to Chlorination	P,G	Cool, 4°C NaOH to pH >12 0.6 g ascorbic acid[6]	14 days[9]	1 l
Fluoride	P	None Required	28 days	250 ml
Halogens, Total Organic	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	2 x 250 ml
Hardness	P,G	HNO_3 to pH <2	6 months	150 ml
Hydrocarbons, Tot Recoverable Pet (IR)	P,G	Cool, 4°C HCl to pH <2	28 days	2 l
Ammonia	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	250 ml
Kjeldahl Nitrogen	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	1 l

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

Parameter	Container[1]	Preservative[2,10]	Recommended Holding Time[3]	Amount of Sample Required
Nitrate	P,G	Cool, 4°C	48 hours	250 ml
Nitrate-Nitrite	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	250 ml
Nitrite	P,G	Cool, 4°C	48 hours	250 ml
Organic Nitrogen	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	1 l
Oil and Grease	G	Cool, 4°C HCl or H_2SO_4 to pH <2	28 days	1 l
Oxygen, Dissolved Probe	G, Bottle and Top	None Required	Analyze Immediately	300 ml
Oxygen, Dissolved Winkler	G, Bottle and Top	Fix on Site and Store in Dark	8 hours	300 ml
Hydrogen Ion (pH)	P,G	None Required	Analyze Immediately	25 ml
Phenolics	G	Cool, 4°C H_2SO_4 to pH <2	28 days	1 l
Orthophosphate	P,G	Filter Immediately Cool, 4°C	48 hours	1 l
Phosphorus, Elemental	G	Cool, 4°C	48 hours	250 ml
Phosphorus, Total	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days	250 ml

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

Parameter	Container[1]	Preservative[2,10]	Recommended Holding Time[3]	Amount of Sample Required
Residue, Total Solids (TS)	P,G	Cool, 4°C	7 days	250 ml
Residue, Filterable Solids (TDS)	P,G	Cool, 4°C	7 days	250 ml
Residue, Non-Filterable Solids (TSS)	P,G	Cool, 4°C	7 days	250 ml
Residue, Settleable	P,G	Cool, 4°C	48 hours	250 ml
Residue, Volatile (TVS)	P,G	Cool, 4°C	7 days	250 ml
Silica	P	Cool, 4°C	28 days	250 ml
Sulfate	P,G	Cool, 4°C	28 days	250 ml
Sulfide	P,G	Cool, 4°C, Add Zinc Acetate plus Sodium Hydroxide to pH >9	7 days	250 ml
Sulfite	P,G	Cool, 4°C	Analyze Immediately	250 ml
Surfactants (MBAS)	P,G	Cool, 4°C	48 hours	1 l
Temperature	P,G	None Required	Analyze Immediately	100 ml
Turbidity	P,G	Cool, 4°C	48 hours	500 ml
Radiological				
Alpha, Beta, and Radium	P,G	HNO_3 to pH <2	6 months	2 l

TABLE 5-1 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR AQUEOUS MATRICES

1. Polyethylene (P) or Glass (G). Although polyethylene or glass may be appropriate for many of the samples, where there is a choice the Laboratory will ship polyethylene containers due to the reduced cost of the containers and shipping. The following containers are available upon request: 1 liter glass with TFE liner; 500 ml glass with TFE liner; 40 ml VOA with TFE septum; 250 ml glass with septum; 1 liter plastic; 250 ml plastic; 500 ml plastic; and 125 ml plastic.

2. Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, the sample may be preserved by maintaining 4°C until compositing and sample splitting is completed.

3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods of time only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period listed in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

4. Samples should be filtered immediately on-site before adding preservative for dissolved metals if dissolved metals are requested.

5. Guidance applies to samples to be analyzed by GC, LC or GC/MS for specific compounds.

6. Should only be used in the presence of residual chlorine.

7. The pH adjustment may be performed upon receipt at the laboratory and may be omitted if samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% sodium sulfate.

8. Maximum holding time is 24 hours when sulfide is present.

9. Samples for acrolein receiving no pH adjustment must be analyzed within three days of sampling.

10. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation regulations.

TABLE 5-2 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR SOLID MATRICES

Parameter	Container[1]	Preservative[5]	Established Holding Time[2]	Minimum Amount of Sample Required
Metals				
Chromium VI	P,G	Cool, 4°C	24 hours	50 g
Mercury	P,G	Cool, 4°C	28 days	50 g
Metals, except	P,G	Cool, 4°C	6 months	50 g
Organics[3,4]				
Base Neutral Acid Extractables (GC/MS)	G, TFE Lined Cap	Cool, 4°C	14 days until extraction, 40 days after extraction	50 g
Polynuclear Aromatic Hydrocarbons	G, TFE Lined Cap	Cool, 4°C	14 days until extraction, 40 days after extraction	50 g
Pesticides/PCBs	G, TFE Lined Cap	Cool, 4°C	14 days until extraction, 40 days after extraction	50 g
Volatile Organics	G, TFE Lined Septum	Cool, 4°C	14 days	50 g
Total Petroleum Hydrocarbons (GC)	P,G	Cool, 4°C	28 days	100 g
Physical Properties				
Acidity	P,G	Cool, 4°C	14 days	50 g
Alkalinity	P,G	Cool, 4°C	14 days	50 g

TABLE 5-2 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR SOLID MATRICES

Parameter	Container[1]	Preservative[5]	Established Holding Time[2]	Minimum Amount of Sample Required
Ammonia	P,G	Cool, 4°C	28 days	50 g
Bromide	P,G	None Required	28 days	50 g
Chloride	P,G	None Required	28 days	50 g
Cyanide, Total and Amenable to Chlorination	P,G	Cool, 4°C	14 days	50 g
Fluoride	P,G	None Required	28 days	50 g
Hydrocarbons, Tot Recoverable Pet (IR)	P,G	Cool, 4°C	28 days	100 g
Hydrogen Ion (pH)	P,G	None Required	Analyze Immediately	50 g
Kjeldahl Nitrogen	P,G	Cool, 4°C	28 days	50 g
Nitrate	P,G	Cool, 4°C	48 hours	50 g
Nitrate-Nitrite	P,G	Cool, 4°C	28 days	50 g
Nitrite	P,G	Cool, 4°C	48 hours	50 g
Oil and Grease	G	Cool, 4°C	28 days	50 g
Organic Nitrogen	P,G	Cool, 4°C	28 days	50 g
Phenols	G	Cool, 4°C	28 days	50 g
Orthophosphate	P,G	Cool, 4°C	48 hours	50 g
Phosphorus, Elemental	G	Cool, 4°C	48 hours	50 g
Phosphorus, Total	P,G	Cool, 4°C	28 days	50 g

TABLE 5-2 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR SOLID MATRICES

Parameter	Container[1]	Preservative[5]	Established Holding Time[2]	Minimum Amount of Sample Required
Silica	P	Cool, 4°C	28 days	50 g
Sulfate	P,G	Cool, 4°C	28 days	50 g
Sulfide	P,G	Cool, 4°C	28 days	50 g
Sulfite	P,G	Cool, 4°C	Analyze Immediately	50 g
Radiological				
Alpha, Beta, and Radium	P,G	Cool, 4°C	6 months	200 g

TABLE 5-2 LABORATORY SAMPLE PRESERVATION SUMMARY
FOR SOLID MATRICES

1. Polyethylene (P) or Glass (G). Although polyethylene or glass may be appropriate for many of the samples, where there is a choice the Laboratory will ship polyethylene containers due to the reduced cost of the containers and shipping. The following containers are available upon request: 100 ml widemouth glass with TFE liner; 250 ml widemouth glass with TFE liner; and 500 ml widemouth glass with TFE liner.

2. Established holding times are those for which there is no specific guidance following the guidelines for water holding times.

3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods of time only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period listed in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

4. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

5. When any sample is to be shipped by common carrier or sent through the United States mail, it must comply with the Department of Transportation regulations.

6.0 SAMPLE CUSTODY

A sample is physical evidence collected from a site or from the environment. As such, each sample must be documented in a manner that makes it legally defensible and which provides all data necessary for proper analysis. Wadsworth/ALERT sampling personnel must complete all proper forms and documents for each sample taken. This documentation is described below.

6.1 Field Operations

6.1.1 Field Sample Logbook

Data from all samples taken by Laboratory personnel is entered in a hard-cover, bound Laboratory Field Sample Logbook consisting of consecutively-numbered 8 1/2" x 11" pages. This Laboratory Field Sample Logbook contains entries which document pertinent field data for each sample including:

- Client
- Name and Address of Field Client
- Project or Sampling Location
- Exact Location of Sample Point
- Sampling Methodology
- Process Generating Sample (as applicable)
- Sample Container Numbers and Volumes
- Date and Time of Collection
- Field Sample Identification Number or Designation
- Field Observations and/or Measurements
- References such as Maps, Sketches, Photographs
- Preservation and Transport Statement
- Name(s) and Signature(s) of Sample Collector(s)

Location of sample points is referenced to an established system, or if this is not available, given in such a manner that it can be clearly identified.

6.1.2 Sample Labels

Permanent Laboratory Sample Labels (Figure 6-1) are used to ensure proper identification and management of collected samples. These gummed labels are completed and affixed to each sample container at the time of collection. Entries on the sample label include:

- Field Sample Identification Number or Designation
- Exact Location of Sample Point

- Date and Time of Collection
- Name of Sample Collector(s)
- Additional Pertinent Field Information

All entries on the Laboratory Sample Label should correspond accordingly with the Laboratory Field Sample Logbook.

6.1.3 Sample Seals

Laboratory Sample Seals (Figure 6-2) are used to detect unauthorized tampering of samples prior to laboratory acceptance. Laboratory Sample Seals are affixed to the sample transport container in a manner that requires seal breakage in order to open the container. Unauthorized seal breakage indicates possible tampering and will render a sample suspect.

6.1.4 Chain-of-Custody Forms

Chain-of-Custody documentation is necessary to track the possession of each sample from collection through analysis. This documentation is especially vital for legal concerns.

Samples submitted to the Laboratory are accompanied by Laboratory Chain-of-Custody Forms (Figure 6-3) to ensure adequate documentation. These forms are completed and sealed within the sample transport container to be opened and examined by the Laboratory Sample Custodian. Pertinent information includes:

- Client
- Project or Sampling Location
- Sample Identification Number or Designation
- Sample Description
- Sample Container Numbers and Volumes
- Purpose of Analysis
- Signatures of Persons Involved in Chain-of-Custody
- Date and Time of Possession

All entries on the Laboratory Chain-of-Custody Form correspond accordingly with the Laboratory Field Sample Logbook and Laboratory Sample Labels.

6.2 Laboratory Operations

Evidentiary documentation procedures continue with the Laboratory. The designated Laboratory Sample Custodian receives and documents all sample submittals into the Laboratory. The Laboratory Sample Custodian examines the condition, preservation, and accompanying documentation of all submitted samples prior to approval and formal acceptance into the Laboratory. Any sample, preservation, or documentation discrepancies (e.g. broken sample container, improper preservations, inadequate sample volume, poor documentation, etc.) are resolved before the sample is approved and actually accepted for analyses. All required acceptance data is then recorded and documented in the Laboratory Sample Log (Figure 6-4) and Laboratory Computerized Data Management System. The sample is then labeled and placed in the secure sample storage area for distribution to the appropriate analyst(s).

WADSWORTH/ALERT
LABORATORIES, INC.

Figure 6-1

Laboratory Sample Label

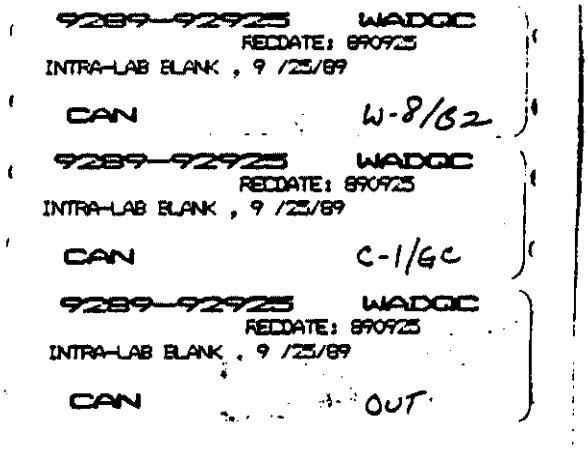

Figure 6-2

Laboratory Sample Seal

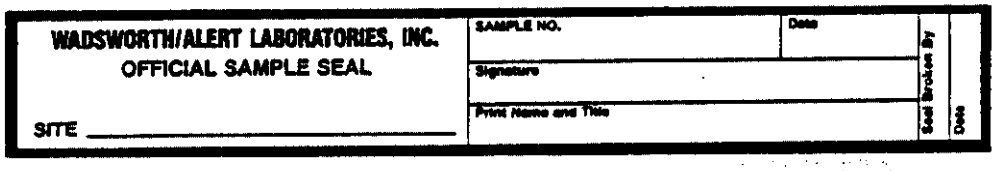

Figure 6-3

Chain of Custody Forms

WADSWORTH/ALERT LABORATORIES

4101 SHUFFEL DRIVE N.W./NORTH CANTON, OHIO 44720

(216) 497-9396

Chain-of Custody Record

№ 4374

PROJ. NO.	PROJECT NAME/LOCATION					NO. OF CONTAINERS	PARAMETER						REMARKS
SAMPLERS: *(Signature)*													
STA. NO.	DATE	TIME	COMP.	GRAB.	STATION LOCATION								

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
Relinquished by: *(Signature)*	Date / Time	Received for Laboratory by: *(Signature)*	Date / Time	Remarks	

Distribution Original Accompanies Shipment. Copy returned with Report.

WADSWORTH/ALERT LABORATORIES, INC.

Figure 6-4

Laboratory Sample Log

WADSWORTH/ALERT LABORATORIES, INC. 890921
SAMPLE RECEIVING LOG SHEET

1884 FF101 INITIALS _____ RECEIVING DATE : 890921 DATE REPORTED OU
SMO. #: 31458 MATRIX: WATER DUE DATE: 891005 STOR. LOC: N/A
SAMPLE ID: AIR STRIPPER EFFLUENT 9-20-89
COMMENTS: CC OF REPORT TO D. STOTHERS.

ANALYSIS: FFH

1885 FF102 INITIALS _____ RECEIVING DATE : 890921 DATE REPORTED OU
SMO. #: 31459 MATRIX: WATER DUE DATE: 891005 STOR. LOC: W-7
SAMPLE ID: PLANT EFFLUENT GRAB
COMMENTS:

ANALYSIS: BOD FFH ISS

1886 MAGOI INITIALS _____ RECEIVING DATE : 890921 DATE REPORTED OU
SMO. #: 31460 MATRIX: N/A DUE DATE: 891005 STOR. LOC: N/A
SAMPLE ID: ADDITIONAL REPORT
COMMENTS:

ANALYSIS: INVOICE

1887 HE101 INITIALS _____ RECEIVING DATE : 890921 DATE REPORTED OU
SMO. #: 31461 MATRIX: WATER DUE DATE: 891005 STOR. LOC: W4844
SAMPLE ID: INTERCEPTOR #2 9-20-89
COMMENTS:

ANALYSIS: CHLIQ FFH METALS 040

SMO. #: 31462 MATRIX: WATER DUE DATE: 891005 STOR. LOC: W4844
SAMPLE ID: INTERCEPTOR #3 9-20-89
COMMENTS:

ANALYSIS: CHLIQ FFH METALS 040

SMO. #: 31463 MATRIX: WATER DUE DATE: 891005 STOR. LOC: W4544
SAMPLE ID: INTERCEPTOR #4 9-20-89
COMMENTS:

ANALYSIS: CHLIQ FFH METALS 040

1888 KC101 INITIALS _____ RECEIVING DATE : 890921 DATE REPORTED OU
SMO. #: 31464 MATRIX: WATER DUE DATE: 891005 STOR. LOC: [illegible]OX
SAMPLE ID: TEST SITE 31N00035602 9-21-89
COMMENTS:

ANALYSIS: FCOLI

7.0 MATERIAL PROCUREMENT AND CONTROL

7.1 Laboratory Material Purchasing

All materials purchased by Wadsworth/ALERT Laboratories, Inc. meet or exceed the specifications required by the methods used by the laboratory. Materials are also purchased to accommodate any project that requires specialized specifications.

7.2 Analytical Standards

Analytical standards (to include calibration standards, surrogate standards, matrix spiking standards, internal standards, and instrument performance evaluation standards) are prepared from materials purchased with a purity of 96% or better. These standards are prepared according to the procedures stated in the individual Analytical Methods. A record of each standard preparation is maintained in the Standards Preparation Log.

All analytical standards are traceable to EMSL-LV or to reputable manufacturers who establish traceability. In the organic portion of the laboratory, traceability is established by comparing the working standards prepared in the laboratory to primary standards obtained by EMSL-LV or reputable manufacturers.

Standard comparison records are maintained by each analytical group.

7.3 Chemical Storage

7.3.1 Requirements for Storage

Every item stocked in a laboratory or storeroom is dated upon receipt. Large quantities of chemicals are not stocked in the laboratory. A current inventory of all chemicals with information on location, quantity, maximum shelf life, and potential hazard is maintained. Chemicals are not stocked in strict alphabetical order since this may result in the storage of incompatible chemicals. When storing, consideration is given to compatibility of chemicals.

7.3.2 Storage of Corrosives

- Caustic and corrosive materials are stored near the floor to minimize danger of bottles falling from shelves.

- Separate containers to facilitate handling. Organic (acetic acid and acetic anhydride) are

stored separately away from strong oxidizing agents (sulfuric, nitric, or perchlorates) to prevent interaction of fumes and corrosion of storage cabinets.

- When transporting acid containers, acid bottle carriers are used.

7.3.3 Storage of Flammables

- In general, liquids having a flash point of 140°F or less are considered flammable.
- Quantities of greater than one gallon are stored in a safety can. If the liquid must be stored in glass for purity, the glass container should be coated in plastic to lessen the danger of breakage and possible ignition.
- Small quantities, no more than is required for work in progress, may be kept on shelves. However, quantities of five gallons or greater are not kept in any laboratory unless contained in a flammable liquids cabinet.
- Flammable liquids are not stored in confined spaces such as a refrigerator.
- Flammable liquids are not stored near strong oxidizing agents such as nitric acid, peroxides, dichromates, or perchlorates.

7.4 Laboratory Waste Disposal

Client samples are retained in a controlled access area for thirty (30) days after the analytical report date. If prior arrangements have been made with the client, the samples are returned to the project site or client by commercial carrier or Wadsworth/ALERT Laboratories' company courier.

All samples slated for disposal are divided into three groups by matrix: aqueous, non-aqueous liquids, and solids. The aqueous samples (groundwaters, drinking waters, industrial effluents) are rinsed through the Laboratory neutralization sump. The non-aqueous liquids (oils, solvents) and the solid samples (soils, industrial waste) are consolidated into respective drums are shipped off-site for incineration as hazardous waste.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 Laboratory Instruments

Wadsworth/ALERT Laboratories uses specific procedures for the operation and calibration of all analytical instruments. Along with proper maintenance, these practices ensure optimum instrument performance and accuracy. These procedures include proper operator training and supervision; mandatory instrument performance specifications; and systematic instrument calibration, verification, and monitoring schedules.

The Laboratory uses mandatory instrument performance specifications to constantly ensure optimum instrumental performance. These performance criteria require acceptable instrument response to specific performance standards prior to initiating further instrument calibration and analyses. Acceptable instrument response criteria are based upon the manufacturer's or EPA's analytical method specifications.

Laboratory analysts record and document all instrumental runs in designated Laboratory Instrument Logbooks (Chapter 10.1.2). These logbooks identify instrument operating parameters, settings, and performance data associated with each instrumental run. Instrumental runs pursuant to establishing instrument performance criteria and calibrations are also recorded in these Laboratory Instrument Logbooks.

The Laboratory uses instrument calibration procedures to constantly ensure analytical accuracy. Initial instrument calibration curves are generated, verified, and routinely monitored throughout the duration of all instrumental analyses (see Table 8-1). Specific calibration procedures for laboratory instruments including the frequency and standards used are listed in Table 8-1 (Calibration Procedures). Table 8-2 (Laboratory Major Analytical Instrumentation) details the equipment that may be used in this project.

8.2 Measurement Equipment, Glassware, Water, Reagents, and Industrial Gases

Wadsworth/ALERT Laboratories adheres to proper standards of good laboratory practice in the use of measuring equipment, glassware, water, chemical reagents, and industrial gases. Adherence to proper standards relating to these laboratory elements validate analytical data. All laboratory glassware, balances, thermometers, and subsequent volume, mass, and temperature measurements are directly traceable to primary standards. Chemical reagents and industrial gases are purchased and used as appropriate for various laboratory applications.

All Laboratory volumetric glassware conforms to National Bureau of Standards (NBS) Class A standards. All mechanical pipettes are calibrated annually with the MLS Pipette Volume Calibration Kit. Kuderna-Danish concentrator tubes are also calibrated annually using gravimetric techniques. All calibrations are recorded and documented in designated Laboratory Calibration Logbooks. Written procedures (SOPs) for cleaning and storing glassware are posted at appropriate wash stations.

Laboratory balances are annually serviced and calibrated under the manufacturer's service contract. Additional balance performance evaluations are conducted routinely by comparison against NBS Class S certified weights. Unacceptable performance requires service adjustments. Both balance service and daily calibrations are recorded and documented in designated Laboratory Balance Calibration Logbooks.

Laboratory and field thermometers are calibrated against a NBS certified thermometer and recorded in the designated Laboratory Thermometer Calibration Logbook. Laboratory drying ovens, incubators, refrigerators, etc. contain calibrated thermometers. Temperature readings are recorded daily in Laboratory Temperature Logbooks. Unacceptable deviation from desired temperatures requires immediate corrective action.

Laboratory pure water is generated by a commercial on-line water purification system consisting of mixed resin deionizing and carbon filtration cartridges. Cartridges are routinely replaced and serviced by the manufacturer or as indicated by an on-line resistivity indicator or laboratory method blank contamination. All water purity information is recorded in the manufacturer's service file. Daily checks are done on the water to prove it is of ASTM Type II quality.

The Laboratory uses various types and purities of chemical reagents, solvents, and industrial gases depending upon their intended use. Laboratory stock and working standards are derived from commercially available primary standards and solvents whenever possible. These stock and working standards are properly labeled (content, concentration, date, analyst) and routinely checked for degradation and/or impurities in accordance with the appropriate analytical method specifications. On-line molecular sieves and oxygen traps are used where appropriate to remove impurities from desired industrial gases. All chemical reagents, solvents, and industrial gases are stored only in designated areas in accordance with the Laboratory Health & Safety Program.

TABLE 8-1 CALIBRATION PROCEDURES

GC/MS VOCs and BNAs

- The Laboratory purchases standards from Supelco for quantitation of VOCs and BNAs.
- Every 12 or 24 hours as the method requires, the instrument is tuned to meet EPA established abundance criteria for DFTPP or BFB to assure that instrument response meets EPA specifications.
- Generation of three (3) or five (5) point calibration curves as the method requires for all method compounds monthly, or more frequently if needed. Recalibration is done when continuing calibration is not met and the compound of interest is present in the sample.
- Verification of system cleanliness by the analysis of a daily reagent blank.
- Addition of internal standards to each sample.

GC VOCs

- The Laboratory purchases standards from Accustandard, Chem Service, and Supelco for quantitation of GC volatiles.
- Generation of three (3) or five (5) point calibration curves for all analyzed compounds monthly or prior to any sample analysis, as stated in the analytical method. Recalibration is done when continuing calibration is not met and the compound of interest is present in the sample.
- Monitor consistency of instrument response through the analysis of a standard after every twenty (20) sample analyses.
- Demonstrate system cleanliness through the analysis of a reagent blank prior to any sample analysis.
- Maintain sample response within the limits of the response of the standards.
- The initial calibration curve must have an RSD of $\leq$20% for Method 8010/8020, $\leq$15% for Method 502.2, and $\leq$10% for Method 601/602 with continuing calibrations of $\leq$15%, $\leq$20%, and $\leq$10% respectively. (RSDs are calculated based on guidance found in SW846, Method 8000, Section 7.4.4.2.)

TABLE 8-1 CALIBRATION PROCEDURES

Pesticides and PCBs

- The Laboratory uses EPA Repository Standards for quantitation of pesticides and PCBs.
- The initial calibration curve must have an RSD of ≤20% with a continuing calibration of ≤15%. (RSDs are calculated based on guidance found in SW846, Method 8000, Section 7.4.4.2.)
- Generation of three (3) or five (5) point calibration curves for all analyzed compounds monthly or prior to any sample analysis, as stated in the analytical method. Recalibration is done when continuing calibration is not met and the compound of interest is present in the sample.
- Monitor consistency of instrument response through the analysis of a standard after every ten (10) sample analyses.
- Demonstrate system cleanliness through the analysis of daily reagent blanks.
- Maintain sample response within the limits of the response of the standards.

ICP

- The Laboratory purchases calibration standards from SPEX, Leeman, J. T. Baker, and Mallinkrodt.
- Generation of a two (2) point calibration and frequent resloping of the curve per manufacturer's requirements.
- Verification of system cleanliness and baseline maintenance through the analysis of a reagent blank every ten (10) samples.
- Verification of instrument consistency through the analysis of a standard every ten (10) samples.
- Determination of instrument stability by the analysis of an interference check sample at the beginning and end of each sample set.
- Maintenance of sample response within the linear response of the instrument.

AA

- The Laboratory purchases calibration standards from SPEX, Leeman, J. T. Baker and Mallinkrodt.
- Construction of a three (3) or four (4) point calibration curve for an element prior to the analysis of each sample set.
- Verification of system cleanliness for each element through the analysis of a reagent blank every ten (10) samples.
- Monitoring of instrument performance by resloping the calibration curve every ten (10) samples. Reslope absorbance must be $\leq$20% of the original curve value.
- Bracketing of sample response between the limits of standard response.

AA Furnace and Mercury Analyzer

- Initial and continuing calibration must meet an RSD of $\leq$20% for AA and Mercury Analyzer.
- Construction of a three (3) point calibration curve for an element prior to the analysis of any sample set per method requirements for the element and instrument.

pH and Ion-Selective Electrode (Fluoride, Ammonia Nitrogen, and Bromide)

- The Laboratory purchases standards from Orion for quantitation of Fluoride, Ammonia Nitrogen, Bromide, and pH.
- Construction of a three (3) point (2 point for pH) calibration curve weekly or prior to the analysis of any sample.
- Bracketing of sample response within the limits of standard response.
- Verification of cleanliness of the analytical system through the analysis of a reagent blank (where applicable).
- Verification of instrument consistency through the analysis of standards after the analysis of every twenty (20) samples (where applicable).

Spectrophotometer (Cyanide, Phosphate, and Methylene Blue Active Substances)

- The Laboratory purchases standards from Orion for cyanide quantitation and Banco for phosphate quantitation. EPA Repository standards are used for the quantitation of surfactants (MBAS).
- Construction of a three (3) point calibration curve prior to the analysis of any sample. The initial calibration curve must have an RSD of $\leq$20%.
- Monitor for the introduction of any interferents through the analysis of a reagent blank prior to any sample analysis.
- Bracket sample response within the standard response.
- Verification of the consistency of instrument response through the analysis of a standard after every twenty (20) sample analyses.

Traacs 800 (Chloride, Sulfate, Nitrate, Nitrite, and Phenols)

- The Laboratory purchases standards from Mallinkrodt for quantitation of phenols, RICCA for quantitation of nitrate and nitrite, and HACH for quantitation of sulfate and chloride.
- The initial calibration curve must be linear with a correlation coefficient between 0.999 and 1.000.
- Construction of a three (3) point calibration curve prior to the analysis of any sample. The initial calibration curve must have an RSD of $\leq$20%.
- Monitor for the introduction of any interferents through the analysis of a reagent blank prior to any sample analysis.
- Bracket sample response within the standard response.
- Verification of the consistency of instrument response through the analysis of a standard after every twenty (20) sample analyses.

Miscellaneous

- Additional inorganic analyses use a single-point standard. The Laboratory purchases standards from HACH for quantitation of COD, BOD, Alkalinity, Acidity, Turbidity (Formazin), and Hardness (as $CaCO_3$). Titrants are purchases from RICCA and Mallinkrodt.
- Analytical Method SOPs, available at the Laboratory, detail the calibration procedures to be used for each method.

NOTE: Information on standards is documented in the Laboratory Standards Logbook (see Chapter 10.1.2.2.10).

TABLE 8-2 LABORATORY MAJOR ANALYTICAL INSTRUMENTATION

Name, Model, & Purchase Dates	Quantity	Dedication	Specifics
Extrel 400 ELQ Gas Chromatograph/ Mass Spectrometer/ Data System 1985-1987	2	Semi-Volatiles	Hewlett Packard 5890 GC Varian 3400 GC, Varian Autosampler Hewlett Packard 7673A Autosampler, Electron Impact (EI) Ionization, 9-Track Magnetic Tape Drive
Hewlett Packard 5996 Gas Chromatograph/Mass Spectrometer/Data System 1985, Leased	1	Semi-Volatiles	Hewlett Packard 5890GC, 7672 Autosampler, Electron Impact (EI) Ionization, 9-Track Magnetic Tape Drive
Hewlett Packard 5890 Gas Chromatograph 1985-1989	13	Semi-Volatiles	Flame Ionization Detector (FID), Dual Ni-62 Electron Capture Detectors (ECD), Nitrogen Phosphorus Detector (NPD), Hewlett Packard 7673 Autosamplers, Hewlett Packard 3359 Chromatography Data System, Hewlett Packard 3393A and 3396 Integrators
Perkin Elmer 8500 Chromatograph 1988	1	Volatiles	Hall Electrolytic Gas Conductivity Detector (HECD), and Photoionization Detector (PID) in Series
Hewlett Packard 5970 MSD 1988	1	Volatiles	HP 5890GC, Tekmar Liquid Sample Concentrator (LSC-2) Purge and Trap, Automatic Liquid Sampler (ALS-2050), Electron Impact (EI) Ionization, 9-Track Magnetic Tape Drive

TABLE 8-2 LABORATORY MAJOR ANALYTICAL INSTRUMENTATION

Name, Model, & Purchase Dates	Quantity	Dedication	Specifics
Finnigan Organic Water Analyzer Gas Chromatograph/ Mass Spectrometer/ Data System 1983, 1984, 1989	3	Volatiles	PE Sigma 3B GCs, Varian 3400 GC, Electron Impact (EI) Ionization, Tekmar Liquid Sample Concentrator (LSC-2) Purge and Trap, Automatic Liquid Sampler (ALS), Model #4200 Automatic Heated Sampler Module, Magnetic Streamer Tape Drive
Tracor 540 Chromatograph 1987-1989	6	Volatiles	Hall Electrolytic Gas Conductivity Detectors (HECD) and Photoionization Detectors (PID) in Series, Tekmar Liquid Sample Concentrator LSC-2000 (Purge and Trap), Tekmar Liquid Sample Concentrator LSC-2 (Purge and Trap), Tekmar Liquid Sample Concentrator LSC 4200 Heated Purge and Trap, Dynatech P&A-30 Autosampler, Hewlett Packard 3359 Chromatography Data System
Finnigan 5100 Gas Chromatograph/ Mass Spectrometer/ System 1986	1	Volatiles	Finnigan 9611 GC, Electron Impact (EI) Ionization, Tekmar Liquid Sample Data Concentrator (LSC-2) Purge and Trap, Automatic Liquid Sampler (ALS) Model #4200 Automatic Heated Sampler Module Magnetic Streamer Tape Drives
Finnigan Incos 50 Gas Chromatograph/ Mass Spectrometer/ Data System 1989	1	Volatiles	Varian 3400 GC, Tekmar Liquid Sample Concentrator (LSC-2) Purge and Trap, Automatic Liquid Sampler (ALS), 9-Track Magnetic Tape Drive

TABLE 8-2 LABORATORY MAJOR ANALYTICAL INSTRUMENTATION

Name, Model, & Purchase Dates	Quantity	Dedication	Specifics
Hewlett Packard 5880A Gas Chromatograph 1987	1	Miscellaneous Analysis	Flame Ionization Detector (FID), Electron Capture Detector (ECD), Thermal Conductivity Detector (TCD), Hewlett Packard 19303A Integrator, Tekmar Liquid Sample Concentration LSC-2 Purge and Trap with Automatic Liquid Sampler (ALS)
Perkin Elmer 50B Mercury Analyzer 1988	1	Mercury Analysis	
Scientific Products HG 4 Mercury Determinator 1989	1	Mercury Analysis	Strip Chart Recorder
Varian SpectrAA-400 1988	1	Metals	96 Graphite Tube Atomizer IBM Model 30 Personal System - 2 Computer Printer
Varian SpectrAA-300/400 1988	2	Metals	Graphite Furnace, IBM Model 30 Personal System - 2 Computer Printer
Varian SpectrAA-20 1987	1	Metals	PSC-56 Programmable Autosampler, VGA-76 Varian Vapor Generator
Perkin Elmer 2380 AA 1987	1	Metals	Atomic Absorption Spectrophotometer
Perkin Elmer 560 AA 1979	1	Metals	Atomic Absorption Spectrophotometer

TABLE 8-2 LABORATORY MAJOR ANALYTICAL INSTRUMENTATION

Name, Model, & Purchase Dates	Quantity	Dedication	Specifics
Perkin Elmer 3030 A 1984	1	Metals	HGA-400 Graphite Furnace, AS-40 Autosampler, Printer, MHS-10, Atomic Absorption Spectrophotometer
Leeman Plasma-Spec Inductively Coupled Plasma 1988	1	Metals	IBM Personal System-2 and Autosampler, Dual Mode-Simultaneous/Sequential
Perkin Elmer Plasma II Inductively Coupled Plasma 1985	1	Metals	Perkin Elmer 7500 Computer System, AS-51 Autosampler, Sequential Mode
Perkin Elmer 710 D Infrared Spectrophotometer 1989	1	Miscellaneous Analysis	
Beckman 4250 Infrared	1	Miscellaneous Analysis	
Technicon Traacs 800 1990	1	Colorimetric Analysis	IBM XT Personal Computer, Epson Printer

Phillips PYE UNICAM PU 8650 Spectrophotometer, 1986
Phillips UNICAM SP6 Series Spectrophotometer, 1986

OI Corporation Model 700 Total Organic Carbon Analyzer, 1989

Mitsubishi Model TOX-10 Total Organic Halogens Analyzer, 1984

9.0 ANALYTICAL PROCEDURES

9.1 Sample Receipt (see Chapter 6.0)

9.2 Sample Preparation

All samples are prepared in accordance with the methods outlined in Tables 9-1 and 9-2 (Methods Summary for Sample Preparation/Sample Extraction and Laboratory Analytical Methods Summary).

9.3 Equipment Startup and Performance Check (see Chapter 11.2.1.1)

9.4 Detection Limits

A summary of common Laboratory detection limits is outlined in Table 9-3 (Laboratory Detection Limits Summary). Detection limits are verified on a quarterly basis. If they do not meet the criteria stated in the Laboratory Quality Control SOP Manual, the initial detection limit study procedure must be followed in full.

9.5 Initial and Continuous Calibration (see Chapter 11.2.1.1, 11.2.1.2, and 11.2.1.4).

9.6 Analytical Methods

A summary of common Laboratory analytical methods is outlined in Table 9-2 (Laboratory Analytical Methods Summary). Specific procedures and variances within the methods are detailed in the Analytical Methods SOPs. The Analytical Methods SOPs are kept on file in the laboratory, available to the analysts at all times.

9.7 Analyses of QC Samples (see Chapter 11.2.1.2 and 11.2.1.3).

9.8 Glassware Cleaning

The procedures used to clean laboratory glassware for use in organic, metals, and inorganic methods are outlined in Table 9-24 (Laboratory Glassware Washing Summary).

TABLE 9-1 METHODS SUMMARY FOR SAMPLE PREPARATION/SAMPLE EXTRACTION

Parameter	Matrix	Method
Metals (ICP) (Method 6010)	Water	30101
Metals (GFAA) (Methods 7131, 7191, 7421, 7841)	Water	3020[1]
Metals (Methods 204.2, 208.2, 213.2, 218.2, 220.2, 239.2, 279.2)	Water	METALS[2] Paragraph 4.1
Metals (RCRA EP Toxicity)	Water/ Solid	1310[1]
Metals (Methods 6010, 7131, 7191, 7421, 7841)	Solid	3050[1]
Purgeables (Methods 8010, 8020)	Water/ Solid	5030[1]
Semivolatiles (Methods 8080, 8100, 8270)	Water	3510[1] 3520[1]
Semivolatiles (Methods 8080, 8100, 8270)	Oil	3580[1]
Semivolatiles (Methods 8080, 8100, 8270)	Solid	3540[1] 3550[1]

1. SW846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, EPA, September 1986.

2. Methods for Chemical Analysis of Water and Wastes, March 1983, EPA-600/4-79-020.

TABLE 9-2 LABORATORY ANALYTICAL METHODS SUMMARY

Parameter	Methods		
	Water	Solid/Liquids Groundwaters	Drinking Water
Metals			
Aluminum	EPA 200.7	SW846 6010	EPA 200.7
Antimony	EPA 200.7, 204.2	SW846 6010	EPA 200.7, 204.2
Arsenic	EPA 206.2, 206.3	SW846 7060	EPA 206.2
Barium	EPA 200.7	SW846 6010	EPA 200.7
Beryllium	EPA 200.7, 210.2	SW846 6010	EPA 200.7, 210.2
Boron	EPA 200.7	SW846 6010	EPA 200.7
Cadmium	EPA 200.7, 213.2	SW846 6010	EPA 213.2
Calcium	EPA 200.7	SW846 6010	EPA 200.7
Chromium	EPA 200.7	SW846 6010	EPA 218.2
Chromium +6	EPA 218.4, 218.5	SW846 7196	
Cobalt	EPA 200.7	SW846 6010	EPA 200.7
Copper	EPA 200.7	SW846 6010	EPA 200.7
Iron	EPA 200.7, 236.2	SW846 6010	EPA 200.7, 236.2
Lead	EPA 200.7, 239.2	SW846 6010	EPA 239.2
Magnesium	EPA 200.7	SW846 6010	EPA 200.7
Manganese	EPA 200.7	SW846 6010	EPA 200.7
Mercury	EPA 245.1	SW846 7470, 7471	EPA 245.1
Molybdenum	EPA 200.7	SW846 6010	EPA 200.7
Nickel	EPA 200.7, 249.2	SW846 6010	EPA 200.7, 249.2
Potassium	EPA 200.7	SW846 6010	EPA 200.7
Selenium	EPA 270.2, 200.7	SW846 7740	EPA 270.2
Silver	EPA 272.2	SW846 6010	EPA 272.2
Sodium	EPA 200.7, 273.2	SW846 6010	EPA 200.7
Thallium	EPA 279.2	SW846 6010	EPA 279.2
Tin	EPA 200.7	SW846 6010	EPA 200.7
Titanium	EPA 200.7	SW846 6010	EPA 200.7
Tungsten	EPA 200.7	SW846 6010	EPA 200.7
Vanadium	EPA 200.7	SW846 6010	EPA 200.7
Zinc	EPA 200.7	SW846 6010	EPA 200.7

TABLE 9-2 LABORATORY ANALYTICAL METHODS SUMMARY

Parameter	Methods		
	Water	Solid/Liquids Groundwaters	Drinking Water
Organics			
Acrolein & Acrylonitrile	EPA 603	SW846 8030	
Base/Neutral & Acid Extractables	EPA 625	SW846 8270	
Chlorinated Herbicides	EPA 615	SW846 8150	EPA 615
Chlorinated Hydrocarbons	EPA 612	SW846 8120	
Haloethers	EPA 611	EPA 611 (Mod)	
Nitroaromatics & Isophorone	EPA 609	SW846 8090	
Nitrosamines	EPA 607	EPA 607 (Mod)	
Organochlorine Pesticides & PCBs	EPA 608	SW846 8080	EPA 808.1
Organohalide Pesticides	EPA 617	SW846 8080	
Organophosphorus Pesticides	EPA 614	SW846 8140	
Organophosphorus Pesticides	EPA 622	SW846 8140	
Phenols	EPA 604	SW846 8040	
Phthalate Esters	EPA 606	SW846 8060	
Polynuclear Aromatic Hydrocarbons	EPA 610	SW846 8100	
Purgeable Halocarbons	EPA 601	SW846 8010	EPA 502.2/504
Purgeable Aromatics	EPA 602	SW846 8020	EPA 502.2/504
Volatile Organics	EPA 624	SW846 8240	
Physical Properties			
Acidity	EPA 305.2		
Alkalinity	EPA 310.1		EPA 310.1, SM403
Ash Content		ASTM D482-80	
Biochemical Oxygen Demand	EPA 405.1		
Bromide	WAL ISE		
BTU/lb		ASTM D2015-85/ D240-85	
Chemical Oxygen Demand	SM 508B	SM 508B	
Chloride	EPA 325.2	SW846 9250	EPA 325.2
Chlorine, Total Residual	EPA 330.5		
Color	EPA 110.3		
Cyanide			
Amenable to Cl	EPA 335.1	SW846 9010	
Total	EPA 335.2	SW846 9010	

TABLE 9-2 LABORATORY ANALYTICAL METHODS SUMMARY

Parameter	Methods		
	Water	Solid/Liquids Groundwaters	Drinking Water
Flash Point		SW846 1010	
Fluoride	EPA 340.2	EPA 340.2	EPA 340.2, SM413B
Hardness	EPA 130.2		EPA 130.2, SM314B
Iodide	EPA 345.1		
Methylene Blue Active Substances	EPA 425.1		
Nitrogen			
Ammonia	EPA 350.2	EPA 350.2	
Kjeldahl, Total	EPA 351.3	EPA 351.3	
Nitrate	EPA 353.3	SW846 9200	EPA 353.2, SM418C
Nitrate-Nitrite	EPA 353.3		EPA 353.2, SM418C
Nitrite	EPA 353.3		
Odor	EPA 140.1		
Oil and Grease, Total Recoverable	EPA 413.1	SW846 9071	
Organo Chlorine		ASTM D2361-85/ D808-81	
Organo Nitrogen	EPA 351.3	EPA 351.3	
Organo Phosphorus	SM Part 424	SM Part 424	
Organo Sulfur		ASTM D3177-75/ D129-64	
Oxygen, Dissolved	EPA 360.2		
pH	EPA 150.1	SW846 9040	SM423
Phenolics, Total	EPA 420.1		
Phosphorus, All Forms	EPA 365.2	EPA 365.2	
Residue			
Filterable	EPA 160.1		
Non-Filterable	EPA 160.2		
Settleable	EPA 160.5		
Total	EPA 160.3	EPA 160.3	
Volatile	EPA 160.4	EPA 160.4	
Silica, Dissolved	EPA 370.1		
Specific Conductance	EPA 120.1	SW846 9050	
Specific Gravity		ASTM D1298-85/ D854-83	

TABLE 9-2 LABORATORY ANALYTICAL METHODS SUMMARY

Parameter	Methods		
	Water	Solid/Liquids Groundwaters	Drinking Water
Sulfate	EPA 375.4	SW846 9035	
Sulfide	EPA 376.1	SW846 9030	
Sulfite	EPA 377.1		
Temperature	EPA 170.1	EPA 170.1	
Total Organic Carbon	EPA 415.1	SW846 9060	
Total Organic Halogen	EPA 450.1	SW846 9020	
Turbidity	EPA 180.1	EPA 180.1	
Viscosity, Brookfield	ASTM D-445		
Water %		ASTM E1064-85	
RCRA Corrosivity		SW846 9040	
RCRA Ignitability		SW846 1010	
RCRA Reactivity		SW846 9010/ 9030	

REFERENCES:

- ASTM - American Society for Testing and Materials.
- EPA Methods - Methods for Organic Chemical Analysis of Municipal And Industrial Wastewater, EPA-600/4-82-057, July 1982.
- EPA - Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020, March 1983.
- SM - Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Sixteenth Edition.
- SW846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition, EPA, September 1986.
- Wadsworth/ALERT Laboratories' Scheme for Waste Compatibility and Consolidation (See Appendix III).

TABLE 9-3 LABORATORY DETECTION LIMITS SUMMARY

Trihalomethanes in Drinking Water
EPA Method 501.1
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l
Chloroform	0.5
Bromodichloromethane	0.5
Dibromochloromethane	0.5
Bromoform	0.5

TABLE 9-4 LABORATORY DETECTION LIMITS SUMMARY

Volatile Organic Compounds in Water
EPA Method 502.2
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l
Benzene	0.5
Bromobenzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Bromomethane	0.5
n-Butylbenzene	0.5
sec-Butylbenzene	0.5
tert-Butylbenzene	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5
Chloroform	0.5
Chloromethane	0.5
2-Chlorotoluene	0.5
4-Chlorotoluene	0.5
Dibromochloromethane	0.5
1,2-Dibromo-3-chloropropane	0.5
1,2-Dibromoethane	0.5
Dibromomethane	0.5
1,2-Dichlorobenzene	0.5
1,3-Dichlorobenzene	0.5

TABLE 9-4 LABORATORY DETECTION LIMITS SUMMARY

Volatile Organic Compounds in Water (Continued)
EPA Method 502.2
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l
1,4-Dichlorobenzene	0.5
Dichlorodifluoromethane	0.5
1,1-Dichloroethane	0.5
1,2-Dichloroethane	0.5
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.5
trans-1,2-Dichloroethene	0.5
1,2-Dichloropropane	0.5
1,3-Dichloropropane	0.5
2,2-Dichloropropane	0.5
1,1-Dichloropropene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,3-Dichloropropene	0.5
Ethylbenzene	0.5
Hexachlorobutadiene	0.5
Isopropylbenzene	0.5
p-Isopropyltoluene	0.5
Methylene chloride	0.5
Naphthalene	0.5
n-Propylbenzene	0.5
Styrene	0.5
1,1,1,2-Tetrachloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
Tetrachloroethene	0.5
Toluene	0.5
1,2,3-Trichlorobenzene	0.5
1,2,4-Trichlorobenzene	0.5
1,1,1-Trichloroethane	0.5
1,1,2-Trichloroethane	0.5
Trichloroethene	0.5
Trichlorofluoromethane	0.5
1,2,3-Trichloropropane	0.5
1,2,4-Trimethylbenzene	0.5
1,3,5-Trimethylbenzene	0.5
Vinyl chloride	0.5
o-Xylene	0.5
m-Xylene	0.5
p-Xylene	0.5

TABLE 9-5 LABORATORY DETECTION LIMITS SUMMARY

Organochlorine Pesticides
EPA Method 509A
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l
Endrin	0.1
g-BHC (Lindane)	0.5
Methoxychlor	0.5
Toxaphene	1

TABLE 9-6 LABORATORY DETECTION LIMITS SUMMARY

Chlorindated Phenoxy Acid Herbicides
EPA Method 509B
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l
2,4-D	0.5
2,4,5-T	0.2
2,4,5-TP (Silvex)	0.1

TABLE 9-7 LABORATORY DETECTION LIMITS SUMMARY

Halogenated Volatile Organics
EPA Method 601
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l
Bromodichloromethane	1
Bromoform	1
Bromomethane	1
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	1
Chloroform	1

TABLE 9-7 LABORATORY DETECTION LIMITS SUMMARY

Halogenated Volatile Organics (Continued)
EPA Method 601
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l
2-Chloroethylvinyl ether	1
Chloromethane	1
Dibromochloromethane	1
1,2-Dichlorobenzene	1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
Dichlorodifluoromethane	1
1,1-Dichloroethane	1
1,2-Dichloroethane	1
1,1-Dichloroethene	1
trans-1,2-Dichloroethene	1
Dichloromethane	1
1,2-Dichloropropane	1
trans-1,3-Dichloropropene	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethene	1
1,1,1-Trichloroethane	1
1,1,2-Trichloroethane	1
Trichloroethene	1
Trichlorofluoromethane	1
Vinyl chloride	1

TABLE 9-8 LABORATORY DETECTION LIMITS SUMMARY

Aromatic Volatile Organics
EPA Method 602
Gas Chromatograph - PID Detector

Routine Detection Limits[1]

Compound	Water ug/l
Benzene	1
Chlorobenzene	1
1,2-Dichlorobenzene	1
1,3-Dichlorobenzene	1

TABLE 9-8 LABORATORY DETECTION LIMITS SUMMARY

Aromatic Volatile Organics (Continued)
EPA Method 602
Gas Chromatograph - PID Detector

Routine Detection Limits[1]

Compound	Water ug/l
1,4-Dichlorobenzene	1
Ethylbenzene	1
Toluene	1

TABLE 9-9 LABORATORY DETECTION LIMITS SUMMARY

Organochlorine Pesticides and PCBs
EPA Method 608
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l
Aldrin	0.05
a-BHC	0.05
b-BHC	0.05
g-BHC (Lindane)	0.05
d-BHC	0.05
Chlordane	0.5
4,4'-DDD	0.1
4,4'-DDE	0.1
4,4'-DDT	0.1
Dieldrin	0.1
Endosulfan I	0.05
Endosulfan II	0.1
Endosulfan sulfate	0.1
Endrin	0.1
Endrin aldehyde	0.1
Heptachlor	0.05
Heptachlor epoxide	0.05
Methoxychlor	0.5

TABLE 9-9 LABORATORY DETECTION LIMITS SUMMARY

Organochlorine Pesticides and PCBs (Continued)
EPA Method 608
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l
Toxaphene	1
PCB-1016	0.5
PCB-1221	0.5
PCB-1232	0.5
PCB-1242	0.5
PCB-1248	0.5
PCB-1254	1
PCB-1260	1

TABLE 9-10 LABORATORY DETECTION LIMITS SUMMARY

Polynuclear Aromatic Hydrocarbons
EPA Method 610
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzo(a)anthracene	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(g,h,i)perylene	10
Benzo(a)pyrene	10
Chrysene	10
Dibenzo(a,h)anthracene	10
Fluoranthene	10
Fluorene	10
Indeno(1,2,3-cd)pyrene	10

TABLE 9-10 LABORATORY DETECTION LIMITS SUMMARY

Polynuclear Aromatic Hydrocarbons (Continued)
EPA Method 610
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
1-Methylnaphthalene	10
2-Methylnaphthalene	10
Naphthalene	10
Phenanthrene	10
Pyrene	10

TABLE 9-11 LABORATORY DETECTION LIMITS SUMMARY

Volatile Organic Compounds
EPA Method 624
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
Acrolein	50
Acrylonitrile	50
Benzene	5
Bromodichloromethane	5
Bromoform	5
Bromomethane	10
Carbon tetrachloride	5
Chlorobenzene	5
Chloroethane	10
2-Chloroethylvinyl ether	10
Chloroform	5
Chloromethane	10
Dibromochloromethane	5
1,1-Dichloroethane	5
1,2-Dichloroethane	5

TABLE 9-11 LABORATORY DETECTION LIMITS SUMMARY

Volatile Organic Compounds (Continued)
EPA Method 624
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
1,1-Dichloroethene	5
1,2-Dichloroethene (Total)	5
1,2-Dichloropropane	5
cis-1,3-Dichloropropene	5
trans-1,3-Dichloropropene	5
Ethylbenzene	5
Methylene chloride	5
1,1,2,2-Tetrachloroethane	5
Tetrachloroethene	5
Toluene	5
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
Trichloroethene	5
Trichlorofluoromethane	5
Vinyl chloride	10

TABLE 9-12 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics
EPA Method 625
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzidine	50
Benzo(a)anthracene	10
Benzo(b)fluoranthene	10
Benzo(k)fluoranthene	10
Benzo(g,h,i)perylene	10
Benzo(a)pyrene	10

TABLE 9-12 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics (Continued)
EPA Method 625
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
Bis(2-chloroethoxy)methane	10
Bis(2-chloroethyl)ether	10
Bis(2-chloroisopropyl)ether	10
Bis(2-ethylhexyl)phthalate	10
4-Bromophenyl phenyl ether	10
Butyl benzyl phthalate	10
2-Chloronaphthalene	10
4-Chlorophenyl phenyl ether	10
Chrysene	10
Dibenzo(a,h)anthracene	10
Di-n-butyl phthalate	10
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	10
1,4-Dichlorobenzene	10
3,3-Dichlorobenzidine	50
Diethyl phthalate	10
Dimethyl phthalate	10
2,4-Dinitrotoluene	10
2,6-Dinitrotoluene	10
Di-n-octyl phthalate	10
Fluoranthene	10
Fluorene	10
Hexachlorobenzene	10
Hexachlorobutadiene	10
Hexachlorocylopentadiene	10
Hexachloroethane	10
Indeno(1,2,3-cd)pyrene	10
Isophorone	10
Naphthalene	10
Nitrobenzene	10
N-Nitrosodimethylamine	10
N-Nitrosodiphenylamine	10
N-Nitrosodi-n-propylamine	10
Phenanthrene	10
Pyrene	10
1,2,4-Trichlorobenzene	10
4-Chloro-3-methylphenol	10

TABLE 9-12 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics (Continued)
EPA Method 625
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l
2-Chlorophenol	10
2,4-Dichlorophenol	10
2,4-Dimethylphenol	10
2,4-Dinitrophenol	50
2-Methyl-4,6-dinitrophenol	50
2-Nitrophenol	10
4-Nitrophenol	50
Pentachlorophenol	50
Phenol	10
2,4,6-Trichlorophenol	10

TABLE 9-13 LABORATORY DETECTION LIMITS SUMMARY

Halogenated Volatile Organics
SW846 Method 8010
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
Benzyl chloride	1	1	2
Bromobenzene	1	1	2
Bromodichloromethane	1	1	2
Bromoform	1	1	2
Bromomethane	1	1	2
Carbon tetrachloride	1	1	2
Chlorobenzene	1	1	2
Chloroethane	1	1	2
Chloroform	1	1	2
1-Chlorohexane	1	1	2
2-Chloroethylvinyl ether	1	1	2
Chloromethane	1	1	2
Chlorotoluene	1	1	2

TABLE 9-13 LABORATORY DETECTION LIMITS SUMMARY

Halogenated Volatile Organics (Continued)
SW846 Method 8010
Gas Chromatograph - Hall Detector

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
Dibromochloromethane	1	1	2
Dibromomethane	1	1	2
1,2-Dichlorobenzene	1	1	2
1,3-Dichlorobenzene	1	1	2
1,4-Dichlorobenzene	1	1	2
Dichlorodifluoromethane	1	1	2
1,1-Dichloroethane	1	1	2
1,2-Dichloroethane	1	1	2
1,1-Dichloroethene	1	1	2
trans-1,2-Dichloroethene	1	1	2
Dichloromethane	1	1	2
1,2-Dichloropropane	1	1	2
trans-1,3-Dichloropropene	1	1	2
1,1,1,2-Tetrachloroethane	1	1	2
1,1,2,2-Tetrachloroethane	1	1	2
Tetrachloroethene	1	1	2
1,1,1-Trichloroethane	1	1	2
1,1,2-Trichloroethane	1	1	2
Trichloroethene	1	1	2
Trichlorofluoromethane	1	1	2
Trichloropropane	1	1	2
Vinyl chloride	1	1	2

TABLE 9-14 LABORATORY DETECTION LIMITS SUMMARY

Aromatic Volatile Organics
SW846 Method 8020
Gas Chromatograph - PID Detector

Routine Detection Limits1

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
Benzene	1	1	2
Chlorobenzene	1	1	2
1,2-Dichlorobenzene	1	1	2
1,3-Dichlorobenzene	1	1	2
1,4-Dichlorobenzene	1	1	2
Ethylbenzene	1	1	2
Toluene	1	1	2
Xylenes	1	1	2

TABLE 9-15 LABORATORY DETECTION LIMITS SUMMARY

Organochlorine Pesticides and PCBs
SW846 Method 8080
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
Aldrin	0.05	0.1	8
a-BHC	0.05	0.1	8
b-BHC	0.05	0.1	8
g-BHC (Lindane)	0.05	0.1	8
d-BHC	0.05	0.1	8
Chlordane	0.5	1	80
4,4'-DDD	0.1	0.2	16
4,4'-DDE	0.1	0.2	16
4,4'-DDT	0.1	0.2	16
Dieldrin	0.1	0.2	16
Endosulfan I	0.05	0.1	8
Endosulfan II	0.1	0.2	16
Endosulfan sulfate	0.1	0.2	16

TABLE 9-15 LABORATORY DETECTION LIMITS SUMMARY

Organochlorine Pesticides and PCBs (Continued)
SW846 Method 8080
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
Endrin	0.1	0.2	16
Endrin aldehyde	0.1	0.2	16
Heptachlor	0.05	0.1	8
Heptachlor epoxide	0.05	0.1	8
Methoxychlor	0.5	1	80
Toxaphene	1	2	160
PCB-1016	0.5	1	80
PCB-1221	0.5	1	80
PCB-1232	0.5	1	80
PCB-1242	0.5	1	80
PCB-1248	0.5	1	80
PCB-1254	1	2	160
PCB-1260	1	2	160
PCB-1262	1	2	160

TABLE 9-16 LABORATORY DETECTION LIMITS SUMMARY

Polynuclear Aromatic Hydrocarbons
SW846 Method 8100
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
Acenaphthene	10	1	330
Acenaphthylene	10	1	330
Anthracene	10	1	330
Benzo(a)anthracene	10	1	330
Benzo(b)fluoranthene	10	1	330
Benzo(k)fluoranthene	10	1	330
Benzo(g,h,i)perylene	10	1	330

TABLE 9-16 LABORATORY DETECTION LIMITS SUMMARY

Polynuclear Aromatic Hydrocarbons (Continued)
SW846 Method 8100
Gas Chromatograph/Mass Spectrometer Detector
GC/MS

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
Benzo(a)pyrene	10	1	330
Chrysene	10	1	330
Dibenzo(a,h)anthracene	10	1	330
Fluoranthene	10	1	330
Fluorene	10	1	330
Indeno(1,2,3-cd)pyrene	10	1	330
1-Methylnaphthalene	10	1	330
2-Methylnaphthalene	10	1	330
Naphthalene	10	1	330
Phenanthrene	10	1	330
Pyrene	10	1	330

TABLE 9-17 LABORATORY DETECTION LIMITS SUMMARY

Clorinated Herbicides
SW846 Method 8150
Gas Chromatograph - ECD Detector

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
2,4-D	0.5	0.5	10
2,4,5-T	0.2	0.2	10
2,4,5-TP (Silvex)	0.1	0.1	10

TABLE 9-18 LABORATORY DETECTION LIMITS SUMMARY

Volatile Organic Compounds
SW846 Method 8240
Gas Chromatograph/Mass Spectrometer Detector
Target Compound List - GC/MS

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
Acetone	50	10	50
Acrolein	50	10	50
Acrylonitrile	50	10	50
Benzene	5	1	5
Bromodichloromethane	5	1	5
Bromoform	5	1	5
Bromomethane	10	2	10
2-Butanone	50	10	50
Carbon disulfide	5	1	5
Carbon tetrachloride	5	1	5
Chlorobenzene	5	1	5
Chloroethane	10	2	10
2-Chloroethylvinyl ether	10	2	10
Chloroform	5	1	5
Chloromethane	10	2	10
Dibromochloromethane	5	1	5
1,1-Dichloroethane	5	1	5
1,2-Dichloroethane	5	1	5
1,1-Dichloroethene	5	1	5
1,2-Dichloroethene (Total)	5	1	5
1,2-Dichloropropane	5	1	5
cis-1,3-Dichloropropene	5	1	5
trans-1,3-Dichloropropene	5	1	5
Ethylbenzene	5	1	5
2-Hexanone	50	10	50
4-Methyl-2-pentanone	50	10	50
Methylene chloride	5	1	5
Styrene	5	1	5
1,1,2,2-Tetrachloroethane	5	1	5
Tetrachloroethene	5	1	5
Toluene	5	1	5
1,1,1-Trichloroethane	5	1	5
1,1,2-Trichloroethane	5	1	5
Trichloroethene	5	1	5
Trichlorofluoromethane	5	1	5

TABLE 9-18 *LABORATORY DETECTION LIMITS SUMMARY*

Volatile Organic Compounds (Continued)
SW846 Method 8240
Gas Chromatograph/Mass Spectrometer Detector
Target Compound List - GC/MS

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
Vinyl acetate	50	10	50
Vinyl chloride	10	2	10
Total Xylenes	5	1	5

TABLE 9-19 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics
SW846 Method 8270
Gas Chromatograph/Mass Spectrometer Detector
Target Compound List - GC/MS

Routine Detection Limits[1]

	Water	Soil	
Compound	ug/l	Routine mg/kg[2]	Low Level ug/kg[2]
Acenaphthene	10	1	330
Acenaphthylene	10	1	330
Anthracene	10	1	330
Benzidine	50	5	1600
Benzo(a)anthracene	10	1	330
Benzo(b)fluoranthene	10	1	330
Benzo(k)fluoranthene	10	1	330
Benzo(g,h,i)perylene	10	1	330
Benzo(a)pyrene	10	1	330
Benzyl alcohol	10	1	330
Bis(2-chloroethoxy)methane	10	1	330
Bis(2-chloroethyl)ether	10	1	330
Bis(2-chloroisopropyl)ether	10	1	330
Bis(2-ethylhexyl)phthalate	10	1	330
4-Bromophenyl phenyl ether	10	1	330
Butyl benzyl phthalate	10	1	330
2-Chloronaphthalene	10	1	300

TABLE 9-19 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics (Continued)
SW846 Method 8270
Gas Chromatograph/Mass Spectrometer Detector
Target Compound List - GC/MS

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
4-Chlorophenyl phenyl ether	10	1	330
Chrysene	10	1	330
Dibenzo(a,h)anthracene	10	1	330
Di-n-butyl phthalate	10	1	330
1,2-Dichlorobenzene	10	1	330
1,3-Dichlorobenzene	10	1	330
1,4-Dichlorobenzene	10	1	330
3,3-Dichlorobenzidine	50	5	1600
Diethyl phthalate	10	1	330
Dimethyl phthalate	10	1	330
2,4-Dinitrotoluene	10	1	330
2,6-Dinitrotoluene	10	1	330
Di-n-octyl phthalate	10	1	330
Fluoranthene	10	1	330
Fluorene	10	1	330
Hexachlorobenzene	10	1	330
Hexachlorobutadiene	10	1	330
Hexachlorocyclopentadiene	10	1	330
Hexachloroethane	10	1	330
Indeno(1,2,3-cd)pyrene	10	1	330
Isophorone	10	1	330
2-Methylnaphthalene	10	1	330
Naphthalene	10	1	330
2-Nitroaniline	50	5	1600
3-Nitroaniline	50	5	1600
4-Nitroaniline	50	5	1600
Nitrobenzene	10	1	330
N-Nitrosodimethylamine	10	1	330
N-Nitrosodiphenylamine	10	1	330
N-Nitrosodi-n-propylamine	10	1	330
Phenanthrene	10	1	330
Pyrene	10	1	330
1,2,4-Trichlorobenzene	10	1	330
Benzoic Acid	50	5	1600
4-Chloro-3-methylphenol	10	1	330

TABLE 9-19 LABORATORY DETECTION LIMITS SUMMARY

Base/Neutral and Acid Extractable Organics (Continued)
SW846 Method 8270
Gas Chromatograph/Mass Spectrometer Detector
Target Compound List - GC/MS

Routine Detection Limits[1]

Compound	Water ug/l	Soil Routine mg/kg[2]	Soil Low Level ug/kg[2]
2-Chlorophenol	10	1	330
2,4-Dichlorophenol	10	1	330
2,4-Dimethylphenol	10	1	330
2,4-Dinitrophenol	50	5	1600
2-Methyl-4,6-dinitrophenol	50	5	1600
2-Methylphenol	10	1	330
4-Methylphenol	10	1	330
2-Nitrophenol	10	1	330
4-Nitrophenol	50	5	1600
Pentachlorophenol	50	5	1600
Phenol	10	1	330
2,4,5-Trichlorophenol	10	1	330
2,4,6-Trichlorophenol	10	1	330

TABLE 9-20 LABORATORY DETECTION LIMITS SUMMARY

Metals
EPA Method 200.7
Inductively Coupled Plasma-Atomic Emission Spectroscopy

Routine Detection Limits[1]

Parameter	Water	Solids[2] (and non-aqueous waste)
Aluminum	0.1 mg/l	5 mg/kg
Antimony	0.2 mg/l	10 mg/kg
Barium	0.01 mg/l	0.5 mg/kg
Beryllium	0.005 mg/l	0.25 mg/kg
Boron	0.1 mg/l	5 mg/kg
Cadmium	0.01 mg/l	0.5 mg/kg
Calcium	0.01 mg/l	0.5 mg/kg
Chromium	0.02 mg/l	1 mg/kg
Cobalt	0.05 mg/l	2.5 mg/kg

TABLE 9-20 LABORATORY DETECTION LIMITS SUMMARY

Metals (Continued)
EPA Method 200.7
Inductively Coupled Plasma-Atomic Emission Spectroscopy

Routine Detection Limits[1]

Parameter	Water	Solids[2] (and non-aqueous waste)
Copper	0.01 mg/l	0.5 mg/kg
Iron	0.05 mg/l	2.5 mg/kg
Lead	0.05 mg/l	2.5 mg/kg
Magnesium	0.01 mg/l	0.5 mg/kg
Manganese	0.01 mg/l	0.5 mg/kg
Molybdenum	0.5 mg/l	25 mg/kg
Nickel	0.04 mg/l	2 mg/kg
Potassium	1 mg/l	50 mg/kg
Silicon	1 mg/l	50 mg/kg
Silver	0.01 mg/l	0.5 mg/kg
Sodium	0.1 mg/l	5 mg/kg
Strontium	0.01 mg/l	0.5 mg/kg
Thallium	0.1 mg/l	5 mg/kg
Tin	1 mg/l	50 mg/kg
Titanium	0.01 mg/l	0.5 mg/kg
Tungsten	0.5 mg/l	25 mg/kg
Vanadium	0.05 mg/l	2.5 mg/kg
Zinc	0.01 mg/l	0.5 mg/kg

OK on AA

OK in Lab. #2

TABLE 9-21 LABORATORY DETECTION LIMITS SUMMARY

Metals
SW846 Method 6010
Inductively Coupled Plasma-Atomic Emission Spectroscopy

Routine Detection Limits[1]

Parameter	Water	Solids[2] (and non-aqueous waste)
Aluminum	0.1 mg/l	5 mg/kg
Antimony	0.2 mg/l	10 mg/kg
Barium	0.01 mg/l	0.5 mg/kg
Beryllium	0.005 mg/l	0.25 mg/kg
Boron	0.1 mg/l	5 mg/kg
Cadmium	0.01 mg/l	0.5 mg/kg

TABLE 9-21 LABORATORY DETECTION LIMITS SUMMARY

Metals (Continued)
SW846 Method 6010
Inductively Coupled Plasma-Atomic Emission Spectroscopy

Routine Detection Limits[1]

Parameter	Water	Solids[2] (and non-aqueous waste)
Calcium	0.01 mg/l	0.5 mg/kg
Chromium	0.02 mg/l	1 mg/kg
Cobalt	0.05 mg/l	2.5 mg/kg
Copper	0.01 mg/l	0.5 mg/kg
Iron	0.05 mg/l	2.5 mg/kg
Lead	0.05 mg/l	2.5 mg/kg
Magnesium	0.01 mg/l	0.5 mg/kg
Manganese	0.01 mg/l	0.5 mg/kg
Molybdenum	0.5 mg/l	25 mg/kg
Nickel	0.04 mg/l	2 mg/kg
Potassium	1 mg/l	50 mg/kg
Silicon	1 mg/l	50 mg/kg
Silver	0.01 mg/l	0.5 mg/kg
Sodium	0.1 mg/l	5 mg/kg
Strontium	0.01 mg/l	0.5 mg/kg
Thallium	0.1 mg/l	5 mg/kg
Tin	1 mg/l	50 mg/kg
Titanium	0.01 mg/l	0.5 mg/kg
Tungsten	0.5 mg/l	25 mg/kg
Vanadium	0.05 mg/l	2.5 mg/kg
Zinc	0.01 mg/l	0.5 mg/kg

TABLE 9-22 LABORATORY DETECTION LIMITS SUMMARY

Miscellaneous Metals

Routine Detection Limits[1]

Parameter	Method	Water	Solids[2] (and non-aqueous waste)
Antimony	204.2	0.2 mg/l	----
Antimony	7041	0.2 mg/l	----
Arsenic	206.2	0.005 mg/l	0.5 mg/kg
Arsenic	7060	0.005 mg/l	0.5 mg/kg
Cadmium	213.2	0.001 mg/l	----

TABLE 9-22 LABORATORY DETECTION LIMITS SUMMARY

Miscellaneous Metals (Continued)

Routine Detection Limits[1]

Parameter	Method	Water	Solids[2] (and non-aqueous waste)
Cadmium	7131	0.001 mg/l	----
Chromium	218.2	0.005 mg/l	----
Chromium	7191	0.005 mg/l	----
Copper	220.2	0.01 mg/l	----
Lead	239.2	0.005 mg/l	0.5 mg/kg
Lead	7421	0.005 mg/l	0.5 mg/kg
Mercury	245.1	0.005 mg/l	0.25 mg/kg
Mercury	7470	0.005 mg/l	0.25 mg/kg
Selenium	270.2	0.005 mg/l	0.5 mg/kg
Selenium	7740	0.005 mg/l	0.5 mg/kg
Silver	272.2	0.005 mg/l	----
Thallium	279.2	0.1 mg/l	----
Thallium	7841	0.1 mg/l	----

TABLE 9-23 LABORATORY DETECTION LIMITS SUMMARY

Miscellaneous Wet Chemistry Parameters

Routine Detection Limits[1]

Parameter	Method	Water	Solids[2] (and non-aqueous waste)
Acidity	305.2	20 ueq/l	----
Alkalinity	310.1	20 mg/l	----
Ammonia Nitrogen	350.2	0.2 mg/l	15 mg/kg
Ash Content	D482-80	0.5 %	0.5 %
Biochemical Oxygen Demand	405.1	2 mg/l	----
Bromide	WAL ISE	0.2 mg/l	----
BTU/lb	D2015-85	----	----
BTU/lb	D240-85	----	----
Chemical Oxygen Demand	508B	5 mg/l	----
Chloride	325.2	2 mg/l	40 mg/kg
Chloride	9250	2 mg/l	40 mg/kg
Chloride-Potable Water	325.2	2 mg/l	----
Chlorine-Total Residual	330.5	0.03 mg/l	----

TABLE 9-23 LABORATORY DETECTION LIMITS SUMMARY

Miscellaneous Wet Chemistry Parameters (Continued)

Routine Detection Limits[1]

Parameter	Method	Water	Solids[2] (and non-aqueous waste)
Chromium (Hexavalent)	307B	0.02 mg/l	1 mg/kg
Chromium (Hexavalent)	7195	0.02 mg/l	1 mg/kg
Color	110.3	----	----
Compatibility		----	----
Corrosivity		0.5 mmpy	----
Cyanide	335.2	0.005 mg/l	0.5 mg/kg
Cyanide	9010	0.005 mg/l	0.5 mg/kg
Flash Point	1010	----	----
Fluoride	340.2	0.1 mg/l	----
Fluoride	314B	0.1 mg/l	----
Hardness	130.2	5 mg/l	----
Ignitability		----	----
Methylene Blue Active Substances	425.1	0.1 mg/l	----
Moisture Content	CRL 445	----	----
Nitrate Nitrogen	353.3	0.1 mg/l	----
Nitrate Nitrogen	9200	0.1 mg/l	----
Nitrate-Potable Water	353.2	0.1 mg/l	----
Nitrate-Potable Water	418C	0.1 mg/l	----
Nitrate-Nitrite	353.3	0.1 mg/l	----
Nitrite Nitrogen	353.3	0.04 mg/l	----
Odor	140.1	----	----
Oil and Grease, Total Recoverable	413.1	1 mg/l	10 mg/kg
Oil and Grease, Total Recoverable	9071	1 mg/l	10 mg/kg
Organo Chlorine	D2361-85	----	----
Organo Chlorine	D808-81	----	----
Organo Nitrogen	351.3	----	----
Organo Nitrogen	CRL 468	----	----
Organo Phosphorus	424	----	----
Organo Sulfur	D3177-75	----	----
Organo Sulfur	D129-64	----	----
Oxygen, Dissolved	360.2	----	----
Orthophosphate	365.2	0.1 mg/l	2 mg/kg
pH	150.1	----	----
pH	9040	----	----
Phenolics, Total	420.1	0.01 mg/l	2 mg/kg

TABLE 9-23 LABORATORY DETECTION LIMITS SUMMARY

Miscellaneous Wet Chemistry Parameters (Continued)

Routine Detection Limits[1]

Parameter	Method	Water	Solids[2] (and non-aqueous waste)
Phosphorus, All Forms	365.2	0.1 mg/l	----
Reactivity			
Cyanide	7.3.3.2	0.5 mg/l	10 mg/kg
Sulfide	7.3.4.1	1 mg/l	50 mg/kg
Residual			
Filterable	160.1	5 mg/l	----
Non-Filterable	160.2	5 mg/l	----
Settleable	160.5	5 mg/l	----
Total	160.3	0.5 %	----
Volatile	160.4	5 mg/l	----
Specific Conductance	120.1	----	----
Specific Conductance	9050	----	----
Specific Gravity	D1298-85	----	----
Specific Gravity	D854-83	----	----
Sulfate	375.4	5 mg/l	100 mg/kg
Sulfate	9035	5 mg/l	100 mg/kg
Sulfide	376.1	1 mg/l	50 mg/kg
Sulfide	9030	1 mg/l	50 mg/kg
Sulfite	377.1	2 mg/l	----
Temperature	170.1	----	----
Tot Recoverable Pet Hydrocarbons	418.1	0.5 mg/l	10 mg/kg
Total Kjeldahl Nitrogen	351.3	0.3 mg/l	----
Total Organic Carbon	415.1	1 mg/l	----
Total Organic Carbon	9060	1 mg/l	----
Total Organic Halogen	450.1	10 ug/l	----
Total Organic Halogen	9020	10 ug/l	----
Total Organic Nitrogen	351.3	0.3 mg/l	----
Turbidity	180.1	----	----
Viscosity	D-445	----	----
Water, %	E1064-85	----	----
RCRA Corrosivity	9040	----	----
RCRA Ignitability	1010	----	----
RCRA Reactivity	9010	----	----
RCRA Reactivity	9030	----	----

LABORATORY DETECTION LIMITS SUMMARY NOTATIONS

1. Note that the above are Practical Quantitation Limits (PQL). Actual quantitation limits may be higher due to matrix interference or a high concentration of a particular analyte.

2. Adjustment of PQLs for dry weight is available upon request. The quantitation limits calculated on a dry weight basis will be higher.

TABLE 9-24 LABORATORY GLASSWARE WASHING SOP

	Metals	Organics	Wet Chemistry
Wash	Hot Water, Detergent Solution	Hot Water Detergent Solution	Hot Water, Detergent Solution
Rinse	3 Times Tap Water 1 Time 1:1 Nitric Acid, 3 Times Type II Water	3 Times Tap Water 3 Times Type II Water	3 Times Tap Water 1 Time 1:1 Hydrochloric Acid 3 Times Type II Water
Dry	Air	Muffle at 400°C for at least 2 hours	Air
Storage	Designated Cabinets and Shelves	Designated Cabinets and Shelves	Designated Cabinets and Shelves

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10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 Laboratory

10.1.1 Data Reduction Methods

10.1.1.1 Data Management System

Wadsworth/ALERT Laboratories uses the Laboratory Computerized Data Management System to record, document, and assimilate pertinent laboratory technical and administrative data. This Laboratory Computerized Data Management System provides data management functions for a number of component laboratory activities including: Laboratory Sample Acceptance, Sample Analytical Results, Sample Status and Tracking, Analytical QA/QC, Final Report Generation, and Client Invoicing. The data management system enhances efficient coordination among these component laboratory activities by providing a highly automated, standardized communication network for data transfer and correlation. This system is summarized below.

The Laboratory Computerized Data Management System assigns an individual Laboratory Identification Number to each sample and records pertinent technical and administrative sample data. Pertinent technical sample data includes the client's sample identification, sample physical description, sampling date (if known), required analytical parameters, and requested completion data. Pertinent administrative data is necessary for final reporting and invoicing of results.

The data system assimilates the above data and generates Laboratory Worksheets (Figure 10-1) for distribution to the appropriate analyst(s). These worksheets identify the appropriate analytical parameters and associated methods necessary to complete the requested sample analyses along with the turnaround time requirements. These turnaround requirements not only specify requested completion dates, but identify

maximum allowable holding times for samples and/or extracts prior to analyses. The data management system also automatically generates appropriate worksheets for the analysis of systematic quality control samples in accordance with Laboratory QC procedures.

Laboratory personnel enter all completed sample analytical results and associated QC data into the Data Management System. The system's various data processing capabilities then automatically provide a number of component laboratory data management functions. These functions include generation of the following materials: QC data statistical evaluations and associated quality control charts (see Chapter 14 for the treatment of outliers), final sample analytical result reports, and sample tracking and status reports.

10.1.1.2 Analytical Systems

All analytical results are calculated using the equations specified in the appropriate EPA method (see Table 9-2).

10.1.2 Data Validation Criteria

10.1.2.1 Data Validation - During Collection

The principle criteria used to validate data integrity during collection are the following:

- Reagent blank results
- Method preparation blank results (See Chapter 11.2.1.3)
- Calibration verification (See Chapter 8)
- Matrix spike/spike duplicate results (See Chapter 11.2.1.2)
- Quality Control check sample results (See Chapter 11.2.1.5)
- Surrogate spike recoveries (See Chapter 11.2.1.4)

- Sampling and field information, if the Laboratory was responsible for sampling.

These measurements are made by the analyst, using specific acceptance criteria. The analyst either proceeds with the analyses or takes corrective action (see Chapter 15). All QC data is reviewed by the appropriate group leader to ensure that all QA procedures have been completed. In addition, 10% of all raw data is reviewed by the group leader to ensure that the method was run in control during the analytical run. Group leaders are responsible for submitting data for computer data entry upon completion of their review.

Organic analytical data generated from a GC/MS may include "B" and "J" flags. "B" denotes a contaminant that is common to both the blank and the sample, while "J" denotes the presence of a compound, but at a level less than the PQL. The Quality Control Narrative flags any problems that were encountered during sample extraction and/or analysis. The narrative contains information on recommended holding times, preservation techniques, container used, surrogates out of control, etc. that may affect the quality of the analytical data.

10.1.2.2 Data Documentation

Wadsworth/ALERT Laboratories uses complete laboratory documentation measures to ensure the integrity and legal validity of all sample analytical results. These documentation measures encompass all analytical activities to create a traceable, legal history of each sample and subsequent analysis. All documented information is recorded in bound, consecutively-numbered analytical logbooks and/or computer data systems. Component analytical documentation measures include:

10.1.2.2.1 Laboratory Sample Logbook

Samples submitted to Wadsworth/ ALERT for laboratory analysis are recorded and documented in the Laboratory Sample Logbook. Individual log entries include: client code, laboratory sample identification number, sample description, analytical requests, chain-of-custody possession statements, and additional information (Figure 6-4).

10.1.2.2.2 Laboratory Worksheets

The analytical specifications and subsequent results of each sample submitted to the Laboratory are recorded on various Laboratory Worksheets (Appendix II, Figure 10-1). These worksheets are generated by the Laboratory Computerized Data Management System from sample information initially entered by the Laboratory Sample Custodian. Pertinent information on the worksheets include Laboratory Sample Identification, requested analytical parameters, maximum holding times and turnaround requests, and analytical results. These worksheets are retained by the Laboratory until all sample analytical results have been entered into the Laboratory Computerized Data Management System.

10.1.2.2.3 Laboratory Method Logbooks

All laboratory analyses are entered into various Laboratory Method Logbooks (Appendix II, Figure 10-2, a-i for examples) which categorically record and document the raw data for each

analytical parameter commonly determined by Wadsworth/ ALERT Laboratories. Each analytical parameter and/or activity is assigned a particular Laboratory Method Logbook which records pertinent preparation, extraction, and instrumental data for each sample. This includes laboratory identification number, initial sample volume or weight, extraction volumes, dilution factors, instrument values, and the initials of the analyst(s). These logbooks also systematically include Wadsworth/ALERT Laboratories ten percent (10%) Analytical Quality Control Program. Method Logbooks are maintained for five years by Wadsworth/ALERT Laboratories.

10.1.2.2.4 Laboratory Instrument Logbooks

All laboratory analyses requiring analytical instrumentation are recorded in various Laboratory Instrument Logbooks (Appendix II, Figure 10-3, a-b) which categorically record and document analytical instrument settings and performance data. These logbooks record instrument calibration data, specific sample volumes, instrument parameters, and corresponding performance data for each sample. Instrumental information has been included and combined with Laboratory Method Logbooks whenever possible to consolidate data. Laboratory Instrument Logbooks are retained for five years.

10.1.2.2.5 Laboratory Instrument Service Logbook

The maintenance, repair, adjustment, and service of all instruments is recorded in appropriate Service Logbooks.

These logbooks, which are retained for five years, record the service histories of various instruments.

10.1.2.2.6 Laboratory Equipment Calibration Logbooks

All Laboratory measuring equipment calibrations are recorded in various Laboratory Calibration Logbooks. These logbooks record the dates and primary standard for calibration of various Laboratory thermometers, balances, and glassware items. The Laboratory Calibration Logbooks are retained for five years.

10.1.2.2.7 Laboratory Chromatography Data File

All chromatography data generated by Wadsworth/ALERT is categorically filed in the Laboratory Chromatography Data File. The files include labeled, numbered chromatograms with corresponding integrator print-outs and raw data sheets (Appendix II, Figure 10-4, a-b). This file is retained for five years.

10.1.2.2.8 Laboratory GC/MS/DS Data File

All chromatography data and corresponding quantitation lists generated by the Laboratory GC/MS/DS Systems are categorically filed in the Laboratory

GC/MS/DS Data File. This file is combined with appropriate Laboratory Chromatography DAta Files for GC data. Processed GC/MS Data is filed on a daily basis in the appropriate Laboratory Processed Data File (VOA, etc., Appendix II, Figure 10-5 a). In addition, all GC/MS/DS chromatography data, quantitation lists, and processed data are recorded on magnetic media. Both hardcopy data and magnetic computerized data are retained by the laboratory for five years.

10.1.2.2.9 Analytical Quality Control Data

The Quality Control Department maintains documents of all data generated by the Analytical Quality Control Program. These files record the raw data and subsequent statistical calculations of various Laboratory quality control components including: continuous method performance evaluations, surrogate spike recovery evaluations, and method blank analyses. Laboratory QA/QC Data Summary Reports containing quality control data statistical summaries and associated quality control charts are routinely generated from this data file (See Appendix II, Figure 10-6 a for examples) QA/QC data files are retained for five years by the laboratory.

10.1.2.2.10 Laboratory Standards Logbook

All laboratory primary standard data is maintained in a Laboratory Standards Logbook. These logbooks are retained for five years.

10.1.3 Data Reporting

Subsequent to data entry, the Quality Control Department is responsible for comparing analytical worksheets with actual data entered in the Data Management System. The Quality Control Department also reviews the quality control report that accompanies the final report.

The Project Manager is then responsible for reviewing the final reports prior to release to the client. Reports are reviewed for:

- Completeness - results for all parameters requested are present; detection limits, units, dates, and sample descriptions are complete and correct.
- Consistency - all parameters are reviewed for internal consistency (CR VI $\leq$ Cr T, TKN $\geq$ NH_3-N, TS $\geq$ TSS, etc.)

The final report is filed after the above review and kept for a minimum of five years.

10.1.3.1 Data Reporting Format

Laboratory Analytical Result Summary Final Reports may include appropriate introductory comments, analytical methods summaries, Quality Control Reports, and invoices in addition to listing sample analytical results and associated QC data. Sample analytical result reports and associated QC data sheets are generated in the appropriate standardized form from the Laboratory Computerized Data Management System. The supporting materials previously mentioned are provided by administrative personnel as appropriate for inclusion in final reports. Additional technical narratives, along with supporting raw data may also in included as warranted by special circumstances (non-typical analyses, matrix interferences, etc.).

Preliminary analytical result summary final reports are provided for those projects requiring rapid analytical turnaround times. These abridged materials primarily contain analytical results. Additional supporting materials may be provided if prearranged. All preliminary reports are followed by final reports.

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11.0 INTERNAL QUALITY CONTROL PROGRAM

Wadsworth/ALERT Laboratories Sampling and Analytical Quality Assurance/ Quality Control Program is designed to ensure the scientific and legal validity of all samples and analytical results. The QA/QC Program consists primarily of a thorough, legal laboratory documentation network in combination with systematic inclusion of various analytical quality control practices into all component laboratory operations. These quality control practices provide constant, documented evaluation and surveillance of acceptable sampling and analytical method performance.

11.1 Internal Quality Control Program (Field)

Field personnel are responsible for collecting the appropriate field blanks as outlined in Chapter 5 as well as sufficient sample for matrix spiking purposes. These will be included in the Quality Control Program within the Laboratory and analyzed accordingly.

11.2 Internal Quality Control Program (Laboratory)

Analytical quality control checks are performed in both the on-site mobile laboratory and the off-site laboratory in identical manner. These procedures are based upon USEPA analytical methods guidance and generally accepted standards of good laboratory practice as outlined in Table 9-2. Key components of the Laboratory Analytical Quality Control Program include the following quality control practices and considerations:

- designation of a Laboratory Quality Control Manager to implement the laboratory QC program (Chapter 2.2).
- designation of a Laboratory Quality Assurance Manager to implement the laboratory QA program.
- adherence to specified Laboratory Sample Acceptance Procedures to ensure proper handling, processing, and storage of submitted samples (Chapter 6.2).
- use of the Laboratory Computerized Data Management System to record, document, and assimilate pertinent laboratory technical and administrative data (Chapter 10.1).
- use of USEPA-approved Analytical Methods and Instrumentation (Chapter 8).
- adherence to mandatory procedures for Operation, Calibration, and Maintenance of Laboratory and Field Instrumentation (Chapters 8 and 13).

- use of proper Laboratory Measuring Equipment, Glassware, Water, Chemical Reagents, Industrial Gases (Chapter 8.3).

- constant surveillance and documentation of acceptable analytical method accuracy and precision through Initial Analytical Method Performance Evaluations (Chapter 11.2.1.1 and matrix spike/spike duplicate evaluations (Chapter 11.2.1.2).

- use of continuous Surrogate Spike Recovery Evaluations where appropriate to ensure acceptable method performance (Chapter 11.2.1.4).

- use of systematic Method Blank Evaluations to identify analytical system interferences and background contamination levels (Chapter 11.2.1.3).

- adherence to proper Laboratory Documentation measures to ensure the complete integrity and legal validity of all Laboratory analyses (Chapter 10.2).

- use of Voluntary Intralaboratory Performance Evaluations in internally assess and evaluate analytical performance (Chapter 12).

- participation in numerous Laboratory certifications, audits, and approval programs (Chapter 12).

11.2.1 Data Quality

The principle criteria for validating data quality is the continuous monitoring of acceptable analytical accuracy, precision, and overall method performance through systematic analysis of quality control samples. Wadsworth/ALERT Laboratories conducts both initial and continuous Analytical Method Performance Evaluations to ensure that all generated analytical data meet acceptable quality control method performance criteria established by the USEPA and the Laboratory. Each analytical method commonly used in the laboratory utilizes specific quality control procedures to continually monitor acceptable analytical method accuracy and precision. These method quality control procedures primarily involve the mandatory systematic insertion of quality control samples into 10% of all laboratory analyses, in addition to strict adherence to instrumental performance and

calibration specifications. These specific quality control procedures are thoroughly detailed in the Analytical Methods Standard Operating Procedures and are based upon USEPA methods guidance (see Table 9-2).

11.2.1.1 Initial Demonstration of Method Proficiency

Prior to the introduction of any new method, the Laboratory conducts a demonstration of method proficiency to show the ability to achieve acceptable method accuracy and precision. This Initial Demonstration of Method Proficiency is summarized below.

A minimum of four (4) spiked samples are prepared using a representative sample matrix. These samples are spiked such that the parameter concentration(s) are within the working range of the method and at least two (2) times greater than the method's background level.

The matrix spike samples are analyzed in accordance with the method. The average percent recovery (R) and the standard deviation of the percent recoveries (s) is calculated from the analytical results. The Laboratory values of R are compared to the published EPA method performance value of average recovery (X). Unacceptable values require the Laboratory to review potential analytical problems and repeat the Initial Demonstration of Method Proficiency until acceptable values are obtained or the limitations of the method are demonstrated. These results are maintained in the Quality Control Department.

11.2.1.2 Matrix Spike/Spike Duplicate Evaluations

Mandatory matrix spike/spike duplicate samples are analyzed at a frequency of 10% in order to maintain continuous surveillance of acceptable method performance. Approximately fifty percent (50%) of all quality control samples are matrix spike samples. Percent Recovery determinations (R) from these results are monitored to provide a measure of the overall accuracy

and precision of the method in addition to determining extraction efficiencies and sample matrix effects (see Chapter 14).

Laboratory quality control charts are constructed from this data in order to monitor and compare actual laboratory quality control data with acceptable published USEPA or Laboratory method performance criteria. (See Figure 11-1 and 11-2 for control charts of MS/MSD data and precision data derived from MS/MSDs.)

11.2.1.3 Method Blank Evaluations

Wadsworth/ALERT Laboratories prepare and analyze daily method blanks for all applicable parameters to evaluate analytical system interferences and background contamination levels. Method blank analyses include all components (glassware, chemical reagents, environment, etc.) of actual, routine method analyses, substituting reagent water or another applicable clean matrix for the actual sample. Approximately twenty-five percent (25%) of all quality control samples are method blanks. Analyses of method blanks provides a safeguard against interfering and/or contaminated reagents, glassware, and laboratory environments. The results of all method blank analyses are recorded in the Laboratory Computer Data Management System. Unfavorable method blank performance renders associated data suspect and requires corrective action (see Chapter 15).

11.2.1.4 Surrogate Spike Recovery Evaluation

Wadsworth/ALERT Laboratories conducts surrogate spike recovery evaluations to ensure acceptable method performance. Surrogate spikes consisting of method compound analogues are added to all GC/MS analyses, GC volatile analyses, and GC pesticide and herbicide analyses to evaluate acceptable method performance. Surrogate spike recoveries must compare favorably to

published USEPA method or statistically derived Laboratory performance limits in order for an analysis to be acceptable.

Unfavorable surrogate spike recoveries render associated data suspect and require corrective action (see Chapter 15).

11.2.1.5 Check Sample Evaluations

Wadsworth/ALERT Laboratories prepare and analyze check samples on each group of samples on a daily basis for all applicable parameters. The purpose of check samples is to continuously evaluate method performance. Approximately twenty-five percent (25%) of all quality control samples are check samples. Percent recovery determinations from these check samples are monitored to provide a continuous measure of each method's accuracy. Laboratory quality control charts are constructed from this data in order to monitor and compare actual check sample data with Laboratory method performance criteria. (See Figure 11-3 for an example check sample control chart.)

11.2.1.6 Corrective Measures

Corrective action for matrix spikes/spike duplicates is based on the control limits for each parameter. The control limits are established by the laboratory on a semiannual basis. Current control limits are found in Chapter 4, Table 4-1. See Chapter 15 for additional corrective measures.

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Figure 11-1

Control Chart - Accuracy

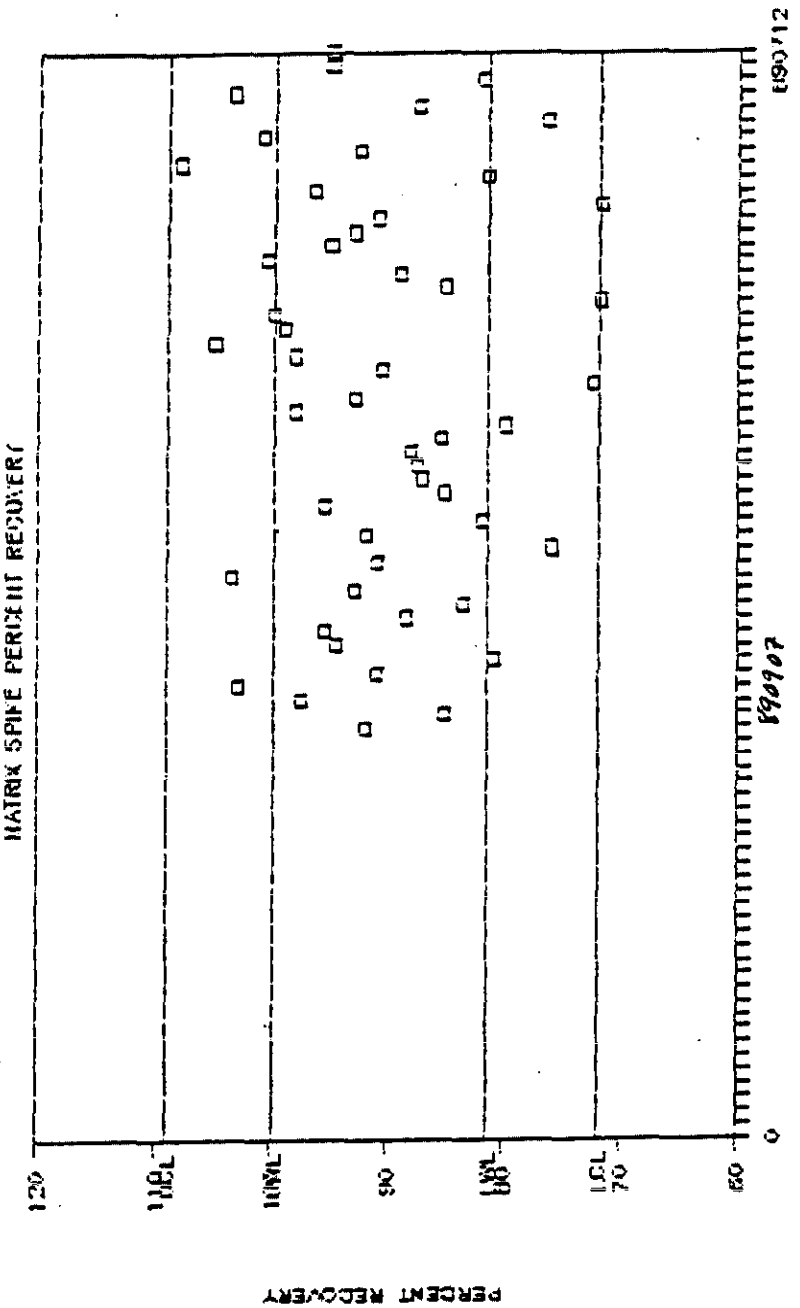


Figure 11-2

Control Chart - Precision

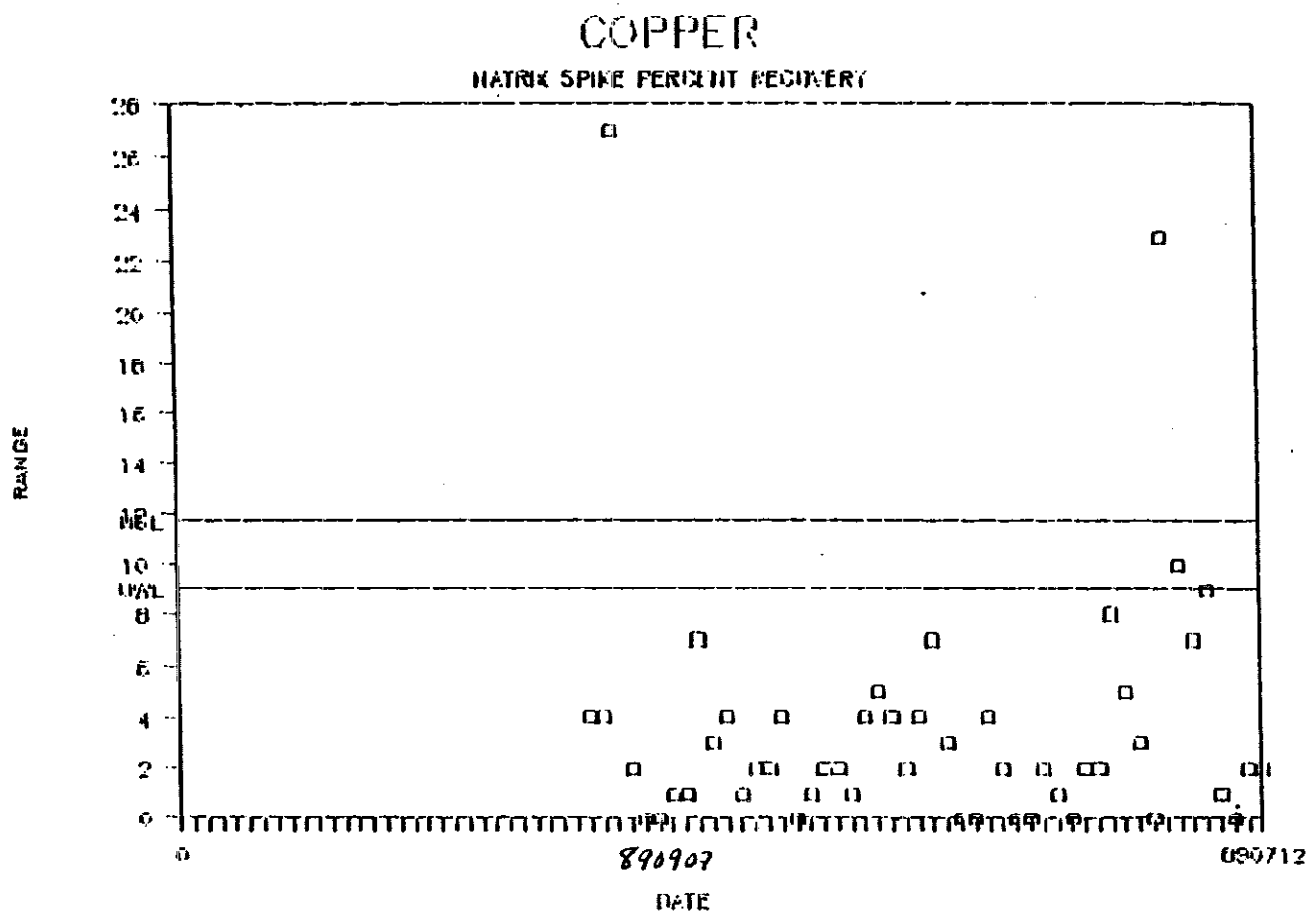
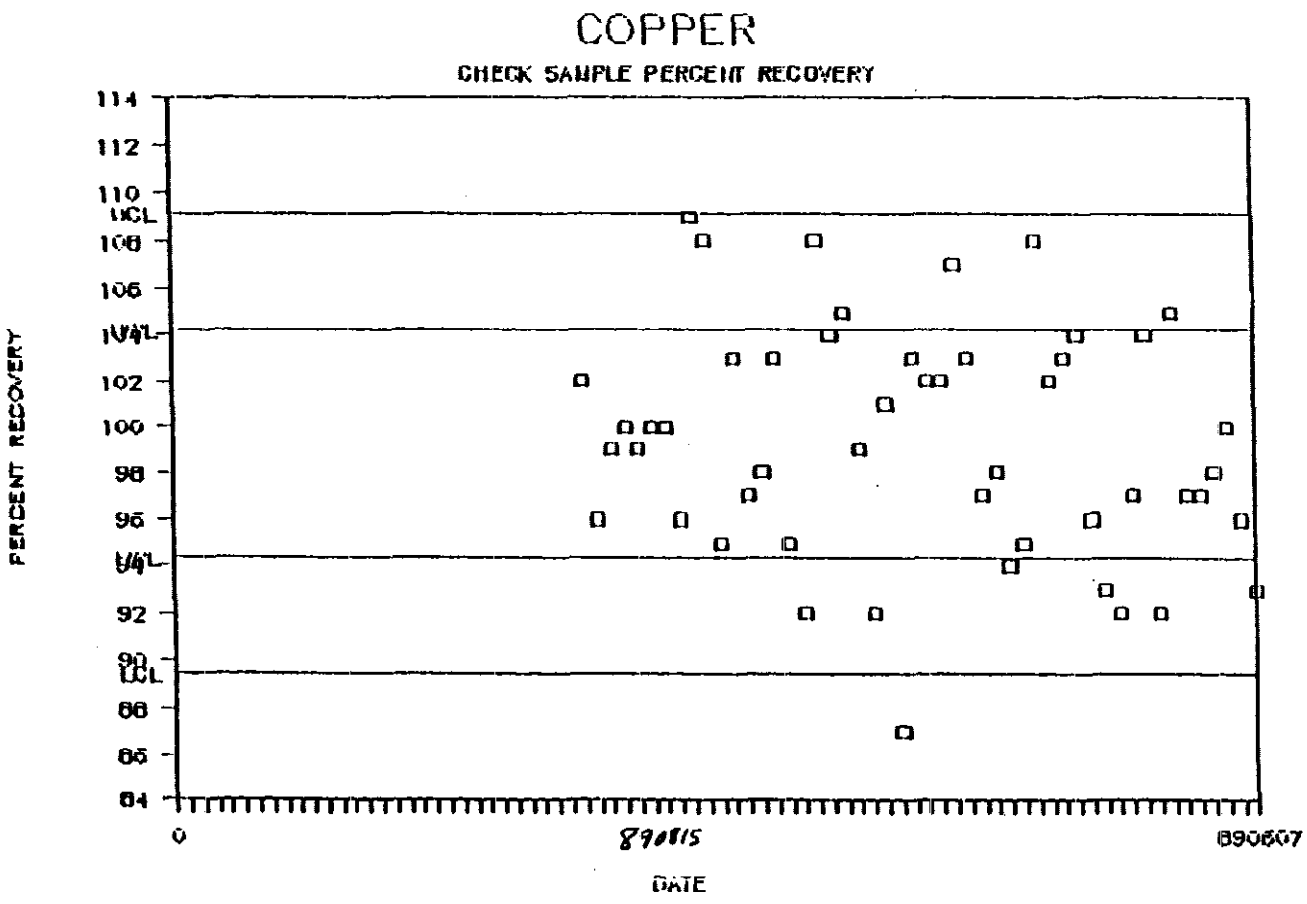


Figure 11-3

Check Sample Control Chart



12.0 PERFORMANCE AND SYSTEMS AUDITS

Wadsworth/ALERT Laboratories participates in a number of performance and systems audits, both internal and external, to monitor the capability and performance of the laboratory and its operations.

12.1 External Laboratory Certifications, Audits, and Approvals

Wadsworth/ALERT Laboratories maintains an internal system of performance and systems audits to verify the quality of its measurement systems. These audits are conducted on a regular basis as a part of normal laboratory operations. In addition, the laboratory participates in a number of federal, state, and private Laboratory Certification, Audit and/or Approval Programs in order to demonstrate its analytical capabilities and expertise. Participation in these programs require the Laboratory to demonstrate acceptable laboratory performance through satisfactory completion of routine systems and/or performance audits. As a part of its certification by these various federal, state, and private agencies, Wadsworth/ALERT Laboratories submits to on-site external systems audits. The inspection audits evaluate the adequacy of laboratory personnel, equipment, documentation, and QA/QC. Performance audits require satisfactory blind analyses of unknown intralaboratory performance evaluation samples. A listing of Laboratory Certifications, Audits, and/or Approvals currently maintained by the Laboratory follows:

Agency	Type of Certification
USEPA	Contract # 68D90022 - Chemical Analytical Services for Organics, Expires 7/91.
USEPA	Zone I/III (Eastern US) ERCS Contract Team Participations Emergency Response and Mobile Analytical Services
US Army Corps of Engineers	Analytical Services for "Superfund" Sites
State of Ohio, EPA	Chemical Analysis of Drinking Water Certification #6090 and #6092
State of California	Certification # E647
State of Connecticut	Certification # PH-0590

Agency	Type of Certification
State of Florida Department of Health and Rehabilitative Services	Certification # E87225
State of Illinois	Certification # 100235
State of Iowa	Laboratory # 85
State of Kentucky Department for Environmental Protection	Laboratory # 90021
State of New Jersey, Department of Environmental Protection	Chemical Analysis of Water and Wastewater, Certification # 74487
State of New York	Chemical Analysis of Potable Water, Non-Potable Water, Solid and Hazardous Waste, Pending Site Visit, Certification # 10975
State of North Carolina	Certification # 39702
State of Pennsylvania Department of Environmental Resources, Bureau of Laboratories	Chemical Analysis of Organochlorine Pesticides, Chlorinated Phenoxy and Herbicides, Trihalomethanes, Vinyl Chloride, Method 502.2 Volatile Compounds ID # 68-340
State of Tennessee	Certification # 02903
State of West Virginia	33-Reciprocal (Ohio)
State of Wisconsin, Department of Natural Resources	Certification LC # 999518190

12.2 Voluntary Intralaboratory Performance Evaluations

Wadsworth/ALERT Laboratories participates in Intralaboratory Performance Evaluations administered by the Laboratory QC Manager. The QC Manager periodically submits single blind performance evaluation samples into the laboratory to assess analytical performance. These single blind performance evaluation samples are generated in-lab by the QC Manager or obtained from various commercial and regulatory sources. These sources and respective analytical parameters are outlined below. When internal criteria

are not met with these Performance Evaluation samples, the Laboratory Manager, Quality Assurance Manager, Technical Director, and appropriate Group Coordinators are notified. They must determine what caused the out-of-control situation and respond to the QC Manager in writing with the corrective action taken. Additional samples of known concentration are then submitted to determine whether or not the corrective action taken was sufficient.

Source	Parameters
USEPA - Environmental Monitoring and Support Laboratory (EMSL)	Trace Metals, Organics, Inorganics
USEPA - Water Quality Survey Performance Standards	Interim Primary Water Quality Parameters, Trihalomethanes
Environmental Resourse Associates	Trace Metals, Organics, Inorganics

12.3 Internal Audits

On a semiannual basis, the Quality Control and Quality Assurance Managers audit the laboratory facilities. The audits include logbook review, chromatogram review, equipment inspection, and compliance with Laboratory Quality Control SOPs. Audit reports are submitted to the Laboratory Technical Director, Operations Director, Laboratory Manager, and Group Coordinators. The Group Coordinators are required to respond in writing to the QC Manager with the corrective actions taken. Depending on the nature of the problems found, follow-up audits are conducted to determine that corrective actions were sufficient and appropriate.

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13.0 PREVENTIVE MAINTENANCE

Wadsworth/ALERT Laboratories maintains a routine training and laboratory equipment maintenance program for all major instrumentation. Laboratory Instrument Service Logbooks are assigned to each instrument to document the service of all equipment included within this program.

13.1 Field Sampling

13.1.1 Instruments and Equipment

The parameters measured in the field include temperature, pH, and specific conductivity. Wadsworth/ALERT Laboratories measures pH using an Orion SA-250 pH meter with a temperature meter for compensated readings. This instrument has the following specifications: relative accuracy (pH) of 0.01 ± 0.01 standard units; maximum error (temperature) of ± 1.0°C; and a range of 2.00 to 19.99 standard units. Specific conductivity is measured using a YSI Model 33 meter with a range of 0 to 50,000 micromohs/cm and an accuracy of 2.5% maximum error. All field equipment are calibrated per the manufacturer's specifications prior to use.

13.1.1.1 pH and Ion-Selective Electrodes

See 13.2.2.4

13.2 Laboratory Instrument and Equipment

13.2.1 Operator Training

All laboratory analysts receive proper training in the operation of applicable instruments prior to actual sample analyses. This training may include attendance at instrument manufacturer's operator training classes and seminars with in-lab instruction and supervision by the group coordinators. This training is augmented and updated as appropriate.

13.2.2 Routine Maintenance Procedures

Wadsworth/ALERT Laboratories maintains a routine laboratory equipment maintenance program for all major instrumentation. For GC and GC/MS instruments, selected operators have been trained to perform routine maintenance procedures (e.g. changing oven fans, replacing electronic control boards, changing vacuum pump oil, cleaning, etc.). For the AA and ICP instruments

the laboratory maintains service contracts with the manufacturers. For the other instrumentation, operators perform routine maintenance (e.g. changing electrodes, changing bulbs, etc.). This program ensures minimal downtime, as well as proper performance. Laboratory Instrument Service Logbooks are assigned to document the service of all equipment included within this program. A substantial spare parts inventory is also maintained to assure timely repair of instruments. When routine maintenance procedures do not correct a problem with instrumentation, outside repair services are available on a next day basis. The laboratory does not maintain test equipment used in the maintenance of instrumentation. Service representatives bring the necessary test equipment for the service call. Additional specific preventive maintenance procedures for laboratory instruments are listed below.

13.2.2.1 GC and GC/MS

- Use of high-quality industrial operating gases combined with on-line installation of molecular sieves and oxygen traps to remove impurities.
- Daily "bake off" of GC and GC/MS columns and detectors to cleanse system.
- Periodic cleaning and reconditioning of detectors as indicated by instrumental performance.
- Monitoring of detector response and overall instrument performance through calibration and verification.
- Periodic cleaning/changing of cooling fans and air filters to ensure proper temperature maintenance.

13.2.2.2 AA

- AA lamps are warmed up for 15 minutes prior to any analysis.
- Weekly cleaning of furnace housing and injector tip.

- Periodic cleaning of windows with alcohol to assure optimal light transmission.
- Daily aspiration of 50 ml of deionized water through the flame assembly or the vapor generation assembly after analyses are complete.
- Periodic washing of the burner assembly and spray chamber in hot water as indicated by instrument response.
- Frequent replacement of pyrolitic graphite furnace tubes as indicated by instrumental performance.
- Utilization of high quality industrial operating gases.
- Monitoring of detector response and instrument performance through calibration and verification.

13.2.2.3 ICP

- Use of high quality operating gases.
- Periodic changing of vacuum pump oil and circulated cooling water.
- Monitoring of detector response and instrument performance through calibration and verification.
- Daily replacement of peristaltic pump tubing.
- Periodic cleaning of nebulizer and spray chamber.
- Daily aspiration of cleaning solution to maintain a clean operating system.

13.2.2.4 pH and Ion-Selective Electrodes

- Rinse probe with deionized water after every analysis and carefully blot off remaining deionized water prior to next analysis.
- Soaking of probe in a suitable solution when instrument is not operating.
- Periodic replacement of the electrodes as indicated by the consistency, repeatability, and stability of the response.

13.2.2.5 Spectrophotometer

- Rinse cuvette with deionized water between analyses.
- Periodic cleaning of windows with alcohol to assure optimal light transmission.
- Periodic replacement of lamps as indicated by the consistency, stability, and repeatability of the response.
- Warm up lamp for 10 minutes prior to any analysis.

13.2.3 Routine Maintenance Procedures for Mobile Laboratory

All laboratory equipment is available for use in mobile laboratory sites by making arrangements with Project Management personnel. While on site, the equipment is maintained as it is in the Laboratory (13.2.2).

13.2.4 Instrument Downtime

Routine maintenance procedures allow the laboratory workload to be scheduled around planned downtime. in the event of unscheduled downtime, samples are diverted to alternate, qualified laboratories. A substantial spare parts inventory is maintained to assure timely repair of instruments and minimize the likelihood of having to send samples out of the laboratory.

14.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Wadsworth/ALERT Laboratories uses specific routine procedures to assess the precision, accuracy, and completeness of its analytical data. These measures include the validation and internal quality control procedures discussed in Chapters 9 and 11.

Specific procedures for assessing data accuracy and precision include calculation of percent recoveries and relative percent differences for all duplicate spike sample analyses. These calculations are summarized below.

a. $$\text{Accuracy} = \text{Percent Recovery } (R\%) = \frac{\text{Observed Conc.}}{\text{Expected Conc.}} \times 100$$

b. $$\text{Precision} = \text{Relative Percent Difference } (RPD) = \frac{(C1 - C2)}{(C1 + C2)/2} \times 100$$

(Where C1 and C2 are concentrations of duplicate spikes.)

c. $$\text{Completeness} = \frac{\text{\# of QC samples in control}}{\text{\# of QC samples attempted}} \times 100$$

NOTE: Refer to the definitions of accuracy, precision, and completeness in Chapter 4.

Analytical control limits are derived from statistical manipulation of each data category using the Dixon or Grubbs tests for the rejection of statistical outliers. The limits are outlined below.

	Accuracy	Precision
Upper Control Limit (UCL)	$\overline{\%R} + 3S$	$\overline{RPD} + 3S$
Lower Control Limit (LCL)	$\overline{\%R} - 3S$	$\overline{RPD} - 3S$

(Where S is Standard Deviation)

Percent Recovery determinations (%R) are entered into the Laboratory computer Data Management System. This Laboratory Computer Data Management System formally records the percent recovery data and calculates the mean, standard deviation and the relative percent difference of each pair, and generates continuous R-S quality control charts of the accuracy for each method commonly used in the Laboratory. The quality control charts provide a continuous indication of method performance by visibly comparing

Laboratory method performance criteria are utilized to evaluate quality control data in the absence of published USEPA method performance criteria. Laboratory method performance criteria are statistically derived from duplicate matrix spike quality control data as follows:

$$\text{Warning Limit (WL)} = \pm 2s$$
$$\text{Control Limit (CL)} = \pm 3s$$

s = standard deviation of the method percent recoveries

A minimum of seven (7) matrix spike sample percent recovery determinations are required to establish the above-stated performance limits. These Laboratory method performance limits are continually redefined as quality control information accumulates.

The mean value percent recovery (R) and standard deviation(s) determinations calculated from the matrix spike quality control results are used to generate Laboratory Method Accuracy Statements for each analytical method commonly used in the Laboratory. Method Accuracy Statements are defined as $R \pm 3s$ and are based upon a minimum of seven (7) matrix spike sample determinations. These statements are updated at least semiannually as calculated from previously accumulated quality control data. All laboratory Method Accuracy Statements are maintained in the Laboratory Quality Control SOP Manual and should be within the recommended EPA criteria.

15.0 CORRECTIVE ACTION

15.1 Laboratory

Wadsworth/ALERT Laboratories routinely uses its quality control data to determine the need for corrective action. Frequent review of data permits rapid identification of an analytical or sampling error and implementation of corrective action.

15.1.1 Determination of the Need for Corrective Action

Percent recovery determinations from the systematic matrix spike and quality control check samples must compare favorably to the published USEPA or laboratory method performance criteria outlined previously in order to validate and approve a corresponding batch of sample analyses. The method analyses are out of control and therefore unacceptable if:

- One data point recovery value is outside of published USEPA performance limits or laboratory control limits (CL).
- Seven consecutive percent recovery values are on one side of R line.

Unacceptable values render the corresponding batch of sample analyses suspect, as do unacceptable results for method blank analyses, until corrective action demonstrates the return of acceptable method performance.

15.1.2 Procedures for Corrective Action

The analyst who reviews and compiles raw data from sample analysis and associated matrix blank, matrix spike, and check samples must immediately notify the QC Manager of deviation from accepted standards. In addition, the QC Manager reviews all QC data to monitor the performance of the analytical system. If any values are outside of QC limits, corrective action are instituted at once.

Corrective action may also be implemented as a result of external performance and systems audits, intra-laboratory comparisons, QA project audits conducted by concerned agencies, or other QA/QC activities.

These corrective actions may involve any phase of the analytical or sampling method including: reagent quality, sample extraction, equipment cleaning, instrument calibration and/or performance, calculations, etc. Specific procedures for corrective action are detailed in the Laboratory Quality Control SOP Manual. For further information on the Internal Quality Control Program, refer to Chapter 11.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Two types of Quality Assurance reports are issued by Wadsworth/ALERT Laboratories; internal reports to management and project reports to clients.

16.1 Internal QA Reports

On a routine basis, the QC Manager, QA Manager, and Technical Director prepare a Quality Assurance Report for Laboratory Management. This report includes the monthly assessments of: the results of any internal or external systems and performance audits; a description of any significant QA problems and suggested corrective actions; and the outcome of any corrective actions taken.

16.2 Project Reports

When requested, the Project Manager presents a QC report to the client representative at the completion of a sampling and/or analytical project. In most cases, this will be a portion of the Analytical Result Summary Final Report. The project report includes the same components as the internal report but is restricted to the information pertinent to a particular project. The project report routinely includes blank and matrix spike data. Check sample data is available upon request.

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WADSWORTH/ALERT
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APPENDIX I

Resumes of Wadsworth/ALERT Laboratories
Technical Management Staff

Marvin W. Stephens	- Technical Director
Robert E. George	- Operations Director
Daniel H. Grove	- Business Development Director
Mark L. Bruce	- Research and Development Manager
J. William Botimer	- Assistant Operations Director
Mark Nebiolo	- Canton Laboratory Manager
Dale L. Mori	- Cleveland Laboratory Manager
Randall C. Grubbs	- Florida Laboratory Manager
John Flaherty	- Pittsburgh Laboratory Manager
Carol Kralik	- Quality Assurance Manager
Connie L. Schussler	- Quality Control Manager
Jeffrey M. Graham	- CLP Manager/Health and Safety Manager
Thomas E. Stiller	- GC/MS Coordinator
James R. Horton	- GC Coordinator
Phyllis Conley	- Inorganic Coordinator
Alesia Danford	- Sample Receiving Coordinator
Bradley E. Belding	- Organic Sample Preparation Specialist
Nicholas C. Zingale	- Sample Procurement Coordinator
Bryce A. Custer	- Project Management Director

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WADSWORTH/ALERT
LABORATORIES, INC.

MARVIN W. STEPHENS

Education:

Doctor of Philosophy, Chemistry
University of Nebraska, 1972

Bachelor of Science, Chemistry
Cedarville College, 1965

Work Experience:

1980 - Present Wadsworth/ALERT Laboratories, Inc., Vice President and Technical Director

1969 - 1980 Professor of Chemistry, Malone College

Summary of Work - Research, Development, and Quality Assurance/Quality Control of Corporate Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys; OSHA-Industrial Hygiene Analysis.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Analytical Methods Research, Development, and Implementation; Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation; Proposal Preparation and Presentation; Technical Report Writing; Contract Administration.

Technical Development and Management

Environmental Analytical Programs - Sampling and Analysis of Air, Water, and Soil: Complete Organic Chemical Characterizations, Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Metals by AA, ICP; TOC; TOX; IR; Conventional Pollutants by UV/VIS Spec., Wet Chemistry; Biological Pollutants, Microbiological Analysis-Coliforms.

Hazardous Waste Management Analytical Programs - Complete Analytical Characterizations and Waste Product Surveys by GC/MS, GC, IR, ICP, AA, Bomb Calorimetry, Flash Point App., UV/VIS Spec., Assorted Wet Chemistry, Waste Compatibility and Consolidation Studies; RCRA Hazardous Waste Characteristic Testing; Decontamination Studies.

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Health and Safety Programs - OSHA Industrial Hygiene Sampling and Analysis; Charcoal Tube, Tenax, Impinger, Filter by GC/MS, GC, AA, ICP, etc.; Personnel Monitoring; Ambient Air Monitoring; Noise Surveys; Industrial Hygiene Surveys.

WADSWORTH/ALERT
LABORATORIES, INC.

ROBERT E. GEORGE

Education:

Master of Science
Environmental Engineering
University of Iowa, 1982

Bachelor of Science, Chemistry
University of Wisconsin, 1971

Work Experience:

1987 - Present	Wadsworth/ALERT Laboratories, Inc., Vice President and Director of Laboratory Operations
1986 - 1987	Wadsworth/ALERT Laboratories, Inc., Laboratory Manager, Cleveland Facility
1979 - 1986	Serco, Technical Services Director
1978 - 1979	Corning Laboratories, Inc., Laboratory Director
1975 - 1978	Carborundum Company, Senior Engineer
1974 - 1975	Norton Company, Marketing Representative
1971 - 1974	Elyria Health Department, Assistant Chemist

Summary of Work - Supervision and Management of Corporate Technical and Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys; OSHA-Industrial Hygiene Analysis.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Analytical Methods Research, Development, and Implementation; Laboratory Data Management and Analytical Program Documentation; Proposal Preparation and Presentation; Technical Report Writing; Contract Administration; Public Relations; Media Relations; Business Marketing and Promotion.

WADSWORTH/ALERT
LABORATORIES, INC.

Technical Development and Management

Environmental Analytical Programs - Sampling and Analysis of Air, Water, and Soil: Complete Organic Chemical Characterizations, Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Metals by AA, ICP; TOC; TOX; IR; Conventional Pollutants by UV/VIS Spec., Wet Chemistry.

Hazardous Waste Management Analytical Programs - Complete Analytical Characterizations and Waste Product Surveys; Waste Compatibility and Consolidation Studies; RCRA Hazardous Waste Characteristic Testing.

Health and Safety Programs - Supervision and Implementation of Health and Safety Practices Programs; Personnel Monitoring; Personnel and Respiratory Protection; Industrial Hygiene Practices.

WADSWORTH/ALERT
LABORATORIES, INC.

DANIEL H. GROVE

Education:

Master of Public Health,
Environmental and Industrial Health
University of Michigan, 1979

Bachelor of Science
Microbiology and Chemistry
Montana State University, 1977

Work Experience:

1988 - Present Wadsworth/ALERT Laboratories, Inc., Vice President and Director of Business Development

1979 - 1988 Wadsworth/ALERT Laboratories, Inc., Vice President and General Manager

Summary of Work - Development and Management of Technical Sampling and Analytical Programs for: USEPA Zone I-III ERCS Contract Participations; Uncontrolled Hazardous Waste Site Clean-Up Operations; Emergency Spill Containment and Clean-Up Projects; Environmental Assessments and Restorations; Industrial Environmental Impact Surveys; Industrial Hygiene Surveys; Health and Safety Programs.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Proposal Preparation and Presentation; Technical Report Writing; Contract Administration; Public Relations; Media Relations; Regulatory Agency Liaison, Business Marketing and Promotion.

Technical Development and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations; Ambient Air Sampling.

Hazardous Waste Management and Clean-Up Programs - Sampling and Analysis of Hazardous Waste: Waste Compatibility and Consolidation Studies; Waste Product Survey Characterizations; Laboratory Waste Categorizations (Lab Packing); Surface Swab Sampling and Analysis; Decontamination Studies; On-Site Treatment and Stabilization Operations.

WADSWORTH/ALERT
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Health and Safety Programs - Design and Management of Health and Safety Practices and Programs: Personnel and Respiratory Protection; Personnel and Equipment Decontamination; Health and Safety Monitoring; Personnel Monitoring; Industrial Hygiene Practices.

WADSWORTH/ALERT
LABORATORIES, INC.

MARK LEE BRUCE

Education:

Doctor of Philosophy, Chemistry
University of Cincinnati, 1984

Bachelor of Science, Chemistry
Mount Union College, 1980

Work Experience:

1987 - Present Wadsworth/ALERT Laboratories, Inc., Research and Development Manager

1985 - 1987 PEI Associates, Inc., GC/MS Instructor and Analyst/Programmer

Summary of Work - Research and Development of GC/MS Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Analytical Methods Research, Development, and Implementation; Laboratory Data Management and Analytical Program Documentation; Development of Scientific Data Acquisition and Manipulation Software; Proposal Preparation and Presentation; Technical Report Writing.

Technical Research, Development, and Management

Environmental Analytical Programs - Analysis of Air, Water, and Soil: Complete Organic Chemical Characterization, Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Metals by AA, ICP.

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WADSWORTH/ALERT
LABORATORIES, INC.

J. WILLIAM BOTIMER

Education:

Bachelor of Science
Chemistry and Mathematics
Malone College, 1979

Additional Training:

Finnigan 1020/OWA Electronics Course

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Assistant Director of Laboratory Operations
1989 - 1990	Wadsworth/ALERT Laboratories, Inc., Canton Laboratory Manager
1987 - 1988	Wadsworth/ALERT Laboratories, Inc., Cleveland Laboratory Manager
1979 - 1987	Wadsworth/ALERT Laboratories, Inc., Technical Manager

Summary of Work - Management and Implementation of Technical Sampling and Analytical Programs for: USEPA Zone I-III ERCS Contract Participations; Uncontrolled Hazardous Waste Site Clean-Up Operations; Emergency Spill Containment and Clean-Up Projects; Environmental Assessments and Restorations; Industrial Environmental Impace Surveys; Industrial Hygiene Surveys; Management and Implementation of Laboratory Maintenance Program.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Instrument Maintenance Program Administration; Laboratory Quality Control Procedures and Practices; Laboratory Data Management and Analytical Program Documentation.

Technical Development and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations; Ambient Air Sampling.

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Hazardous Waste Management and Clean-up Programs - Sampling and Analysis of Hazardous Waste: Waste Compatibility Studies; Waste Product Survey Characterizations; Laboratory Waste Characterizations (Lab Packing); Surface Swab Sampling and Analysis; Decontamination Studies; On-Site Treatment and Stabilization Operations.

Health and Safety Programs - Supervision and Implementation of Health and Safety Practices and Programs; Personnel and Respiratory Protection; Personnel and Equipment Decontamination; Health and Safety Monitoring; Personnel Monitoring; Industrial Hygiene Practices.

Analytical Methods and Instrumentation - Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Volatile Organics by GC/P&T; TOC; TOX; TCLP; AA.

WADSWORTH/ALERT
LABORATORIES, INC.

MARK NEBIOLO

Education:

Master of Science, Biology
West Virginia University, 1981

Bachelor of Science, Agriculture and Forestry
West Virginia University, 1977

Additional Training:

American Chemical Society, "Effective Management of Chemical Analysis Laboratories"
Society of Analytical Chemists of Pittsburgh, Hazardous Waste Seminar
Spectroscopy Society of Pittsburgh, Applications of Hybrid Techniques in Mass Spectrometry
Finnigan Mat Institute, Basic Mass Spectral Interpretation
Giardia Technical Analysis Workshop, USEPA
Operation of the Finnigan MAT 4000 Series GC/MS System and Operation of the Finnigan MAT Series 2000/INCOS Data System
OSHA - Forty Hours Hazardous Training

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Canton Laboratory Manager
1989 - 1990	Wadsworth/ALERT Laboratories, Inc., GC/MS Group Coordinator
1982 - 1989	FREE-COL Laboratories, Laboratory Manager

Summary of Work - Management and Implementation of Technical Sampling and Analytical Programs for: USEPA Zone I-III ERCS Contract Participations; Uncontrolled Hazardous Waste Site Clean-Up Operations; Emergency Spill Containment and Clean-Up Projects; Environmental Assessments and Restorations; Industrial Environmental Impace Surveys; Industrial Hygiene Surveys; Management and Implementation of Laboratory Maintenance Program.

WADSWORTH/ALERT
LABORATORIES, INC.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Instrument Maintenance Program Administration; Laboratory Quality Control Procedures and Practices; Laboratory Data Management and Analytical Program Documentation.

Technical Development and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations; Ambient Air Sampling.

WADSWORTH/ALERT
LABORATORIES, INC.

DALE L. MORI

Education:

Bachelor of Science, Biological Sciences
Ohio State University, 1976

Work Experience:

1989 - Present	Wadsworth/ALERT Laboratories, Inc., Cleveland Laboratory Manager
1986 - 1989	Wadsworth/ALERT Laboratories, Inc., Assistant Manager, Cleveland Laboratory
1981 - 1986	Herron Testing Laboratories, Analytical Services

Summary of Work - Supervision and Management of Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys; OSHA-Industrial Hygiene Analysis.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Analytical Program Management; Laboratory Data Management and Analytical Program Documentation; Proposal Preparation and Presentation; Technical Report Writing; Contract Administration; Business Marketing and Promotion.

Technical Program and Management

Environmental Analytical Programs - Sampling and Analysis of Air, Water, and Soil: Complete Organic Chemical Characterizations, PCBs, Organics by GC; Metals by AA; IR; Conventional Pollutants by UV/VIS Spec., Wet Chemistry.

Hazardous Waste Management Analytical Programs - Complete Analytical Characterizations and Waste Product Surveys; Waste Compatibility and Consolidation Studies; RCRA Hazardous Waste Characteristic Testing.

Health and Safety Programs - Supervision and Implementation of Health and Safety Practices and Programs; Personnel Monitoring; Personnel and Respiratory Protection; Industrial Hygiene Practices.

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WADSWORTH/ALERT
LABORATORIES, INC.

RANDALL C. GRUBBS

Education:

Bachelor of Science, Chemistry
Kent State University, 1985

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Florida Laboratory Manager
1987 - 1990	Wadsworth/ALERT Laboratories, Inc., GC Group Coordinator and Assistant Laboratory Director
1985 - 1987	Wadsworth/ALERT Laboratories, Inc., Chemist

Summary of Work - Supervision and Management of GC Analytical Group Programs for: CERCLA - Environmental Assessments and Restorations: RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Research, Development, and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Hazardous Waste Management and Clean-Up Program - Sampling and Analysis of Hazardous Waste: Waste Compatibility and Consolidation Studies; Waste Product Survey Characterizations; Laboratory Waste Categorizations (Lab Packing); Surficial Swab Sampling and Analysis; Decontamination Studies; On-Site Treatment and Stabilization Operations.

Analytical Methods and Instrumentation - Priority Pollutants, Herbicides, Pesticides, PCBs, Organics by GC; Volatile Organics by GC/P&T, TOC; TOX; Conventional Pollutants by UV/VIS Spec. and Wet Chemistry.

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LABORATORIES, INC.

Health and Safety Programs - Supervision and Implementation of Health and Safety Practices and Programs; Personnel Monitoring; Personnel and Respiratory Protection; Industrial Hygiene Practices.

WADSWORTH/ALERT
LABORATORIES, INC.

JOHN FLAHERTY

Education:

Bachelor of Science
Chemistry/Physics
University of Pittsburgh, 1980

12 Credits toward Master of Science
Physical Chemistry
University of Pittsburgh

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Pittsburgh Laboratory Manager
1989 - 1990	Keystone Environmental Resources, Inc., Laboratory Director
1988 - 1989	Keystone Environmental Resources, Inc., Project Manager
1985 - 1988	Koppers Company, Inc., Quality Assurance Manager
1983 - 1985	Microbac Laboratories, Inc., Laboratory Director
1981 - 1983	Microbac Laboratories, Inc., Chemist

Summary of Work - Management and Implementation of Technical Sampling and Analytical Programs for: USEPA Zone I-III ERCS Contract Participations; Uncontrolled Hazardous Waste Site Clean-Up Operations; Emergency Spill Containment and Clean-Up Projects; Environmental Assessments and Restorations; Industrial Environmental Impace Surveys; Industrial Hygiene Surveys; Management and Implementation of Laboratory Maintenance Program.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Instrument Maintenance Program Administration; Laboratory Quality Control Procedures and Practices; Laboratory Data Management and Analytical Program Documentation.

Technical Development and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations; Ambient Air Sampling.

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LABORATORIES, INC.

Hazardous Waste Management and Clean-up Programs - Sampling and Analysis of Hazardous Waste: Waste Compatibility Studies; Waste Product Survey Characterizations; Laboratory Waste Characterizations (Lab Packing); Surface Swab Sampling and Analysis; Decontamination Studies; On-Site Treatment and Stabilization Operations.

Health and Safety Programs - Supervision and Implementation of Health and Safety Practices and Programs; Personnel and Respiratory Protection; Personnel and Equipment Decontamination; Health and Safety Monitoring; Personnel Monitoring; Industrial Hygiene Practices.

Analytical Methods and Instrumentation - Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Volatile Organics by GC/P&T; TOC; TOX; TCLP; AA.

WADSWORTH/ALERT
LABORATORIES, INC.

CAROL KRALIK

Education:

Master of Science, Biology
(Microbiology Concentration)
Duquesne University, 1977

Bachelor of Science, Biology
Duquesne University, 1973

Additional Training:

Chemical Toxicology
Capillary Chromatography
Extrel ELQ 400 Operating Training Course
Finnigan 4500 In-House Training

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Quality Assurance Manager
1987 - 1989	Wadsworth/ALERT Laboratories, Inc., GC/MS Group Coordinator
1986 - Present	Wadsworth/ALERT Laboratories, Inc., Senior Chemist
1979 - 1986	NUS - GC/MS Chemist and Group Leader
1972 - 1979	NUS - Analytical Chemist and Microbiologist

Summary of Work - GC/Mass Spectroscopist for USEPA Contract #68-01-7156, Chemical Analytical Services for Organics; Supervision and Management of GC/MS Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Development and Management

Analytical Programs - Analysis of USEPA Contract #68-01-7156 samples by GC/MS, Priority Pollutants by GC/MS; Herbicides, Pesticides, and PCBs.

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WADSWORTH/ALERT
LABORATORIES, INC.

CONNIE L. SCHUSSLER

Education:

Bachelor of Science
Chemistry and Zoology
Olivet Nazarene University, 1981

Additional Training:

GC Audio Course, ACS
HPLC Training Course, Waters Company
HPLC Training Course, Milton Roy
Laboratory Quality Assurance and Assessment
for Environmental Testing, A2LA

Work Experience:

1988 - Present	Wadsworth/ALERT Laboratories, Inc., Quality Control Manager
1987 - 1988	Wadsworth/ALERT Laboratories, Inc., Senior Chemist
1987 - 1986	Armour Pharmaceutical Company, GC Group Coordinator
1981 - 1986	Armour Pharmaceutical Company, Quality Control Analyst

Summary of Work - Management of Laboratory Quality Assurance/Quality Control Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Assurance/Quality Control Program Administration; Laboratory Data Management and Analytical Program Documentation.

Technical Research, Development, and Management

Environmental Assessment Programs - Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

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Analytical Methods and Instrumentation - Priority Pollutants, Herbicides, PCBs, Organics by GC; HPLC, GC/P&T.

Laboratory Quality Control Program - Formulation of Laboratory Quality Control Sample Spikes, Reference Samples, Control Charts, Accuracy Statements, etc.

WADSWORTH/ALERT
LABORATORIES, INC.

JEFFREY M. GRAHAM

Education:

Bachelor of Science, Chemistry
Muskingum College, 1984

Work Experience:

1985 - Present Wadsworth/ALERT Laboratories, Inc., CLP and Health & Safety Manager

1984 - 1985 Gould, Inc., Chemical Analyst

Summary of Work - Extraction Specialist for USEPA Contract #68-01-7156, Chemical Analytical Services for Organics and Gas Chromatographer for Full-Service, Environmental Analytical Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Water Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys; OSHA-Industrial Hygiene Analysis.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Research, Development, and Management

Analytical Programs - Extraction of BNA, Pesticide, PCBs, Volatiles (Soil) Fractions of USEPA Contract #68D90022 samples; Herbicides, Pesticides, PCBs, Organics by GC.

Health and Safety Programs - Design and Management of Health and Safety Practices and Programs: Personnel and Respiratory Protection; Personnel and Equipment Decontamination; Health and Safety Monitoring; Personnel Monitoring; Industrial Hygiene Practices.

WADSWORTH/ALERT
LABORATORIES, INC.

THOMAS E. STILLER

Education:

Bachelor of Science, Biology
Clarion State College, 1975
Clarion, Pennsylvania

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., GC/MS Section Leader
1988 - 1989	Wadsworth/ALERT Laboratories, Inc., GC/MS Analyst
1985 - 1988	Free-Col Laboratories, GC/MS Operator
1984 - 1985	Free-Col Laboratories, Chemical Technician

Summary of Work - Implementation of GC and GC/MS Analytical Group Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Development and Management

Environmental Assessment Programs - Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Analytical Programs - Organic Extractions; Volatiles, Pesticides, PCB Analysis by GC; Volatile Organic Compounds by GC/MS; GC/Mass Spectroscopist for USEPA Contract #68017156.

WADSWORTH/ALERT
LABORATORIES, INC.

JAMES R. HORTON

Education:

Bachelor of Science, Chemistry
University of Akron, 1987

Carnegie Mellon College, Chemistry
Pittsburgh, Pennsylvania

Work Experience:

1987 - Present Wadsworth/ALERT Laboratories, Inc., Chemist - GC Group

Summary of Work - Implementation of GC Group Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Research, Development, and Management

Environmental Assessment Programs - Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Analytical Methods and Instrumentation - Herbicides, Pesticides by GC; PCB's and Volatiles. samples for Pesticides and PCBs by GC.

WADSWORTH/ALERT
LABORATORIES, INC.

PHYLLIS A. CONLEY

Education:

Bachelor of Science
Biology and Chemistry
West Virginia University, 1973

Work Experience:

1988 - Present	Wadsworth/ALERT Laboratories, Inc., Inorganics Group Coordinator
1987 - 1988	Wadsworth/ALERT Laboratories, Inc., Chemist
1977 - 1986	The Timken Company, Senior Chemist
1974 - 1977	The Timken Company, Chemical Technologist

Summary of Work - Supervision and Management of Inorganic Analytical Group Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Technical Research, Development, and Management

Environmental Assessment Programs - Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Hazardous Waste Management and Clean-Up Programs - Analysis of Hazardous Waste: Waste Compatibility and Consolidation Studies; Waste Product Survey Characterizations; Decontamination Studies; On-Site Treatment and Stabilization Operations.

Analytical Methods and Instrumentation - Inorganic Analysis by UV/VIS; X-Ray Fluorescence, X-Ray Diffraction; Optical Emission Spectrometers, Grating Spectrographs, AA/Graphite Furnace, DCP/ICP Spectrometers; Wet Chemistry.

WADSWORTH/ALERT
LABORATORIES, INC.

ALESIA DANFORD

Education:

Chemistry Coursework
Kent State University, 1987

Chemistry Coursework
Akron University, 1986

Work Experience:

1988 - Present	Wadsworth/ALERT Laboratories, Inc., Sample Receiving Coordinator
1986 - 1988	Wadsworth/ALERT Laboratories, Inc., Sample Receiving Custodian
1984 - 1986	Wadsworth/ALERT Laboratories, Inc., Inorganic Laboratory Technician

Summary of Work - Management of Laboratory Sample Receiving Operations, Sample Receiving and Shipping.

Fields of Competence:

Administrative Development and Management

Project Management and Supervision - Laboratory Sample Control Program; Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation; Laboratory Sample Management.

Technical Development and Management

Analytical Programs - Inorganic Analysis by UV/VIS; Spectrometry and Wet Chemistry

WADSWORTH/ALERT
LABORATORIES, INC.

BRADLEY E. BELDING

Education:

Bachelor of Science, Chemistry
Akron University, 1987

Work Experience:

1990 - Present	Wadsworth/ALERT Laboratories, Inc., Senior Organic Sample Preparation Specialist
1988 - 1990	Wadsworth/ALERT Laboratories, Inc., Organic Sample Preparation Specialist
1985 - 1988	Eaton Oil Company, Chemist

Summary of Work - Implementation of Sample Preparation Group Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation.

Environmental Assessment Programs - Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Analytical Methods and Instrumentation - Atomic Absorption Spectrophotometer, Gas Chromatography, UV/VIS Spectrophotometer, Nuclear Magnetic Resonance.

WADSWORTH/ALERT
LABORATORIES, INC.

NICHOLAS C. ZINGALE

Education:

Bachelor of Science
Environmental Health
Bowling Green State University, 1989

Work Experience:

1989 - Present	Wadsworth/ALERT Laboratories, Inc., Coordinator, Field Services, Hazardous Material Manager, Safety Director
1988 - 1989	United States Public Health Service, Environmental Engineer
1987 - 1988	Bowling Green State University Biology Lab, Laboratory Technician

Summary of Work - Management and Implementation of Technical Sampling Programs for: Uncontrolled Hazardous Waste Site Clean-Up Operations; Emergency Spill Containment and Clean-Up Projects; Environmental Assessment and Restorations; Industrial Environmental Impact Surveys. Management of Facilities Hazardous Materials and Health & Safety Programs.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory and Field Quality Control Procedures and Program Documentation; Waste Management; Health & Safety.

Technical Development and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations.

Hazardous Waste Management and Clean-Up Programs - Sampling and Analysis of Hazardous Waste: Waste Compatibility and Consolidation Studies; Waste Product Survey Characterizations; Laboratory Waste Categorizations (Lab Packing); Surficial Swab Sampling and Analysis; Decontamination Studies; On-Site Treatment and Stabilization Operations.

Health & Safety Programs - Management & Implementation of Facilities Waste Management Programs; Health & Safety Programs.

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WADSWORTH/ALERT
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BRYCE A. CUSTER

Education:

Bachelor of Science, Chemistry
Kent State University, 1985

Additional Training:

Capillary Chromatography
Extrel ELQ 400 Operator Training Course
Lachat Operator Training Course
Region V State and Federal Regulation Course

Work Experience:

1988 - Present	Wadsworth/ALERT Laboratories, Inc., Project Management Director
1986 - 1988	Wadsworth/ALERT Laboratories, Inc., Chemist, GC/MS
1985 - 1986	Wadsworth/ALERT Laboratories, Inc., Inorganics Group Coordinator
1980 - 1985	Wadsworth/ALERT Laboratories, Inc., Laboratory Technician

Summary of Work - Supervision and Management of Project Management Programs for: CERCLA-Environmental Assessments and Restorations; RCRA-Industrial Waste Management and Groundwater Monitoring; SDWA-Drinking Water Standards Compliance Monitoring and Water/Wastewater Treatment Evaluations; NPDES-Industrial Effluent Discharge and Pretreatment Permitting and Monitoring; Surface Water Evaluations; TSCA-PCB Surveys.

Fields of Competence:

Administrative Development and Management

Project Development and Management - Laboratory Quality Control Procedures and Programs; Laboratory Data Management and Analytical Program Documentation; Business Marketing and Promotion; Proposal Preparation and Presentation.

Technical Research, Development, and Management

Environmental Assessment Programs - Sampling and Analysis of Air, Water, and Soil: Surface Water Evaluations; Groundwater Monitoring; Industrial Discharge Monitoring; Soil Surveys; Subsurface Investigations; Complete Organic Chemical Characterizations; Priority Pollutants, HSL Parameters by GC/MS; Herbicides, Pesticides, PCBs, Organics by GC; Conventional Pollutants by UV/VIS Spec., Wet Chemistry.

WADSWORTH/ALERT
LABORATORIES, INC.

Hazardous Waste Management and Clean-Up Programs - Sampling and Analysis of Hazardous Waste: Waste Compatibility and Consolidation Studies; Waste Product Survey Characterizations; Surface Swab Sampling and Analysis; Complete Analytical Characterizations and Waste Product Surveys; Waste Compatibility and Consolidation Studies; RCRA Hazardous Waste Characteristic Testing.

Analytical Methods and Instrumentation - Priority Pollutants, Herbicides, Pesticides, PCBs, Organics by GC and GC/MS; Volatile Organics by GC/P&T; Conventional Pollutants by UV/VIS Spec., and Wet Chemistry; Analysis of USEPA Contract #68-01-7156 Samples by GC/MS.

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APPENDIX II

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Figure 10-1

METALS WORKSHEET - CANTON

PROJECT MGR. :
CLIENT CODE : WADGC

SAMPLE MATRIX :
SITE :
SAMPLING DATE:

AMOUNT RECEIVED :
SAMPLE ID : INTRA-LAB BLANK ,
STORAGE LOCATION :
COMMENTS

LAB NUMBER :
RECEIVING DATE :
REQUEST DATE :
HOLDING EXP. DATE:
DUE DATE :99
** NOON **
PRIORITY :

VOC : BNA : PEST : METAL : WET :

PREPARATION DATE : _____
SAMPLE WEIGHT : _____

PREPARATION : TOTAL
PREP CHARGE : _____

ELEMENT	RESULT	UNITS	LOL	PREPARATION/ ANALYSIS DATE	INITIALS	
Ag						A I F H
Al						A I F H
As						A I F H
B						A I F H
Ba						A I F H
Be						A I F H
Ca						A I F H
Cd						A I F H
Co						A I F H
Cr						A I F H
Cr+						A I F H
Cu						A I F H
Fe						A I F H
Hg						A I F H
K						A I F H
Mg						A I F H
Mn						A I F H
Mo						A I F H
Na						A I F H

Figure 10-2a

Bomb Methods Logbook

WADSWORTH TESTING LABORATORIES/ALERT INC.
BOMB LOGSHEET

SAMPLE ID	MATRIX	SAMPLE WEIGHT	CRUCIBLE INITIAL	CRUCIBLE FINAL	DIFFERENCE	CONC %	COMMENTS	DATE	ANALYST
DUPLICATE									
SPIKE									

Figure 10-2b

GC Volatile Extraction Logbook

WADSWORTH/ALERT LABORATORY

GC-VOLATILE LOGSHEET

SAMPLE ID	COMPANY ID	DATE EXTRACTED	ANALYST INITIALS	AMOUNT EXTRACTED	INITIAL pH	ADJUSTED pH	SOLVENT VOLUME (ml)	EXCHANGE SOLVENT	FINAL VOLUME (ml)	SURROGATE ADDED	COMMENTS

Nº 527

Figure 10-2c

EP Toxicity Leachate Logbook

WADSWORTH TESTING LABORATORIES / ALERT INC.

EP TOXICITY LEACHATE LOGSHEET

SAMPLE ID:					SAMPLE ID:				
WEIGHT:					WEIGHT:				
COMMENTS:					COMMENTS:				
TIME	pH	Acid/Base	DATE	ANALYST	TIME	pH	Acid/Base	DATE	ANALYST

FORM 230

WADSWORTH/ALERT
LABORATORIES, INC.

Figure 10-2d

Flashpoint Method Logbook

WADSWORTH TESTING LABORATORIES/ALERT INC.
FLASHPOINT LOGSHEET

SAMPLE ID	MATRIX	METHOD			START TEMP	FLASH TEMP	COMMENTS	DATE	ANALYST
		PM	CC	OC					
CALIBRATION	STANDARD						EXPECTED TEMP:		
CALIBRATION	STANDARD						EXPECTED TEMP:		
CALIBRATION	STANDARD						EXPECTED TEMP:		

FORM #160

Nº 473

Figure 10-2e

Grammetric Method Logbook

WADSWORTH/ALERT LABORATORIES, INC.

TOTAL SOLIDS, ASH, TOTAL VOLATILE SOLIDS

Sample Number	Prep Date	Analysis Date	Analyst Initials	Sample Size	Weight Before	Weight After	Difference	Weight After Ignition	Total Solids Result	Total Ash Result	Total Volatile Solids	Units

WADSWORTH/ALERT LABORATORIES, INC.

Figure 10-2f

Metals Method Logbook

WADSWORTH/ALERT LABORATORIES, INC.

GRAPHITE FURNACE ANALYSIS

SAMPLE ID	ELEMENT	WAVE-LENGTH	SLIT WIDTH	VOL/WT. FACTOR	DILUTION	INSTR VALUE	FINAL CONC.	QC	COMMENTS	TIME	DATE	ANALYST

Form #251

NO 5567

Figure 10-2g

pH Method Logbook

WADSWORTH TESTING LABORATORIES / ALERT INC.

pH LOGSHEET

SAMPLE ID	MATRIX	pH, s.u.	TEMP	4.0 STD	7.0 STD	10.0 STD	COMMENTS	DATE	ANALYST

Figure 10-2h

Spectrophotometric Method Logbook

WADSWORTH TESTING LABORATORIES/ALERT INC.
SPECTROPHOTOMETRIC LOG SHEET

SAMPLE ID	MATRIX	WAVELENGTH	VOLUME/WEIGHT	DILUTION	INSTR VALUE	FINAL CONC	COMMENTS	DATE	ANALYST
SPIKE									
BLANK									
DUPLICATE									

WADSWORTH/ALERT LABORATORIES, INC.

Figure 10-2i

Titrimetric Method Logbook

WADSWORTH/ALERT Laboratories, Inc.
TITRIMETRIC LOGSHEET

SAMPLE I.D.	SAMPLE VOLUME	DILUTION	TITRANT NORMALITY	TITRANT VOLUME	FINAL CONCENTRATE	COMMENTS	DATE	ANALYST

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LABORATORIES, INC.

Figure 10-3a

GC Instrument Logbook

WADSWORTH TESTING LABORATORIES / ALERT INC.

GC INSTRUMENT LOGSHEET

SAMPLE DATA						GC PARAMETERS									DETECTOR				PERFORMANCE STANDARDS				COMMENTS	ANALYST
ID#	POSITION	FILE	MO/DD/YR	% SOL	VOLUME ul/mg	COLUMN	INJ °C	INIT		RATE °C/min	FINAL		FLOW ml/min	PRESS psi	TYPE	ATTN	RANGE	°C	A		B			
								°C	min		°C	min							RT	RESPONSE	RT	RESPONSE		

Form #[illegible]

№ ...431

WADSWORTH/ALERT
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Figure 10-3b

GC/MS Instrument Logbook

Wadsworth/ALERT Laboratories, Inc.

Instrument : OWA B

page 35

Date : _____

Case : _____

Column

Type: _____

Length: _____ m

I.D. _____ mm

Flow rate: _____

Temperature Program

8F8

____°C for ___ min
to ____°C @ ____°C/min
hold ___ min

Analysis

____°C for ___ min
to ____°C @ ____°C/min
hold ___ min

Purge & Trap

Trap: _____

Purge: 11 min

Desorb: 4 min @ 180 °C

Bake: 10 (min) min @ 200 °C

Auto num	Sample ID lot# sample#	Client	File name	Amt purged	Sample Prep	comments	Analys

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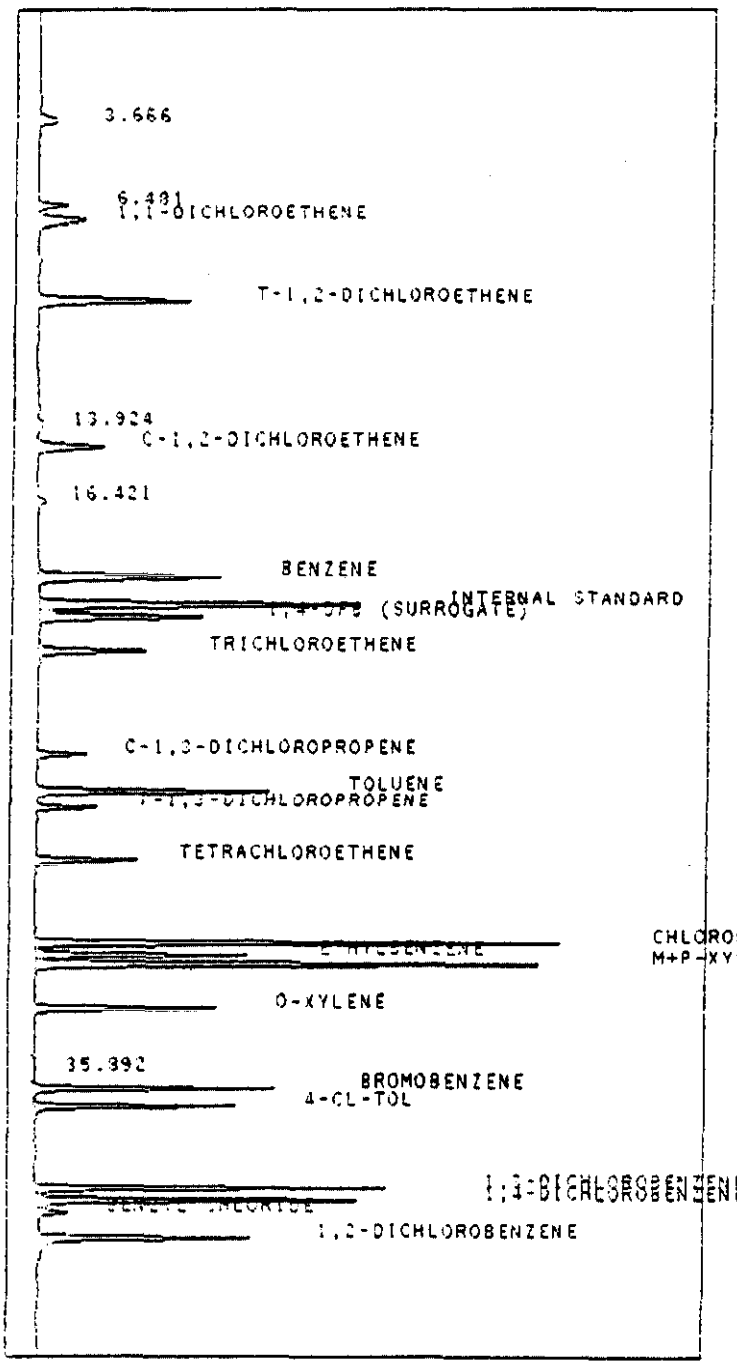
Figure 10-4a

Laboratory Sample Chromatogram

Example: GC VOC Chromatogram



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LABORATORIES, INC.

Figure 10-4b

Laboratory Chromatography Data

Example: Chromatography Raw Data

GC ID_____

Analyst _____

Run Date _____

DATA SHEET

Sample ID#						
Dilution/Injection						
Initial						
Final						
Run #						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TIME / AREA						
TOTAL AREA						
RF USED						
CONC.						
LDL						
NOTES						

WADSWORTH/ALERT
LABORATORIES, INC.

Figure 10-5a

Laboratory Processed Data File

Example: VOA

Quantitation Report File: VOL10714

Data: VOL10714.TI
09/20/89 4:25:00
Sample:
Conds.: 510000
Formula: Instrument: 5100 Weight: 0.000
Submitted by: Analyst: Acct. No.:

AMOUNT=AREA * REF AMNT/(REF AREA * RESP FACT)
Resp. fac. from Library Entry

No	Name
1	BROMOCHLOROMETHANE
2	1,4-DIFLUOROBENZENE
3	CHLOROBENZENE-D5
4	CHLOROMETHANE
5	BROMOMETHANE
6	VINYL CHLORIDE
7	CHLOROETHANE
8	METHYLENE CHLORIDE
9	ACETONE
10	CARBON DISULFIDE
11	1,1-DICHLOROETHENE
12	1,1-DICHLOROETHANE
13	1,2-DICHLOROETHENE (TOTAL)
14	CHLOROFORM
15	1,2-DICHLOROETHANE
16	2-BUTANONE
17	1,1,1-TRICHLOROETHANE
18	CARBON TETRACHLORIDE
19	VINYL ACETATE
20	BROMODICHLOROMETHANE
21	1,2-DICHLOROPROPANE
22	CIS-1,3-DICHLOROPROPENE
23	TRICHLOROETHENE
24	DIBROMOCHLOROMETHANE
25	1,1,2-TRICHLOROETHANE
26	BENZENE
27	TRANS-1,3-DICHLOROPROPENE
28	BROMOFORM
29	4-METHYL-2-PENTANONE
30	2-HEXANONE
31	TETRACHLOROETHENE
32	1,1,2,2-TETRACHLOROETHANE
33	TOLUENE
34	CHLOROBENZENE
35	ETHYLBENZENE
36	STYRENE
37	XYLENE (TOTAL)
38	TOLUENE-D8
39	BROMOFLUOROBENZENE
40	1,2-DICHLOROETHANE-D4
41	2-CHLOROETHYL VINYL ETHER
42	M-XYLENE
43	1,3-DICHLOROBENZENE
44	1,2-DICHLOROBENZENE
45	1,4-DICHLOROBENZENE
46	ACROLEIN
47	ACRYLONITRILE

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LABORATORIES, INC.

Figure 10-5a

Laboratory Processed Data File

Example: VOA

No	Name
48	TRICHLOROFLUOROMETHANE
49	BIS(CHLOROMETHLY)ETHER
50	DICHLORODIFLUOROMETHANE

No	m/z	Scan	Time	Ref	RRT	Meth	Area(Hght)	Amount		%Tot
1	129	240	8:00	1	1.000	A BB	78903.	250.000	NG	7.64
2	114	505	16:50	2	1.000	A BB	487167.	250.000	NG	7.64
3	117	625	20:50	3	1.000	A BB	409042.	250.000	NG	7.64
4	NOT FOUND									
5	NOT FOUND									
6	NOT FOUND									
7	NOT FOUND									
8	84	144	4:48	1	0.600	A BB	26416.	67.661	NG	2.07
9	43	161	5:22	1	0.671	A BB	12913.	115.401	NG	3.53
10	NOT FOUND									
11	96	226	7:32	1	0.942	A BB	101355.	314.281	NG	9.61
12	63	262	8:44	1	1.092	A BB	5166.	8.099	NG	0.25
13	96	283	9:26	1	1.179	A BB	1912.	4.023	NG	0.12
14	NOT FOUND									
15	NOT FOUND									
16	NOT FOUND									
17	97	351	11:42	2	0.695	A BB	127336.	138.489	NG	4.23
18	117	351	11:42	2	0.695	A BB	17572.	20.561	NG	0.63
19	NOT FOUND									
20	NOT FOUND									
21	NOT FOUND									
22	NOT FOUND									
23	130	430	14:20	2	0.851	A BB	249360.	311.662	NG	9.53
24	NOT FOUND									
25	NOT FOUND									
26	78	441	14:42	2	0.873	A BB	396652.	236.537	NG	7.23
27	NOT FOUND									
28	NOT FOUND									
29	43	523	17:26	3	0.837	A BB	439.	0.943	NG	0.03
30	NOT FOUND									
31	NOT FOUND									
32	NOT FOUND									
33	92	599	19:58	3	0.958	A BB	325779.	258.670	NG	7.91
34	112	629	20:58	3	1.006	A BB	411564.	243.908	NG	7.45
35	NOT FOUND									
36	NOT FOUND									
37	NOT FOUND									
38	98	594	19:48	3	0.950	A BB	492048.	261.276	NG	7.99
39	95	767	25:34	3	1.227	A BB	308145.	227.585	NG	6.96
40	65	315	10:30	1	1.312	A BB	135184.	290.894	NG	8.89
41	NOT FOUND									
42	NOT FOUND									
43	NOT FOUND									
44	NOT FOUND									
45	146	1040	34:40	3	1.664	A VB	951.	1.083	NG	0.03
46	NOT FOUND									
47	NOT FOUND									
48	NOT FOUND									
49	NOT FOUND									
50	85	68	2:16	1	0.283	A BB	19770.	20.435	NG	0.62

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Figure 10-6a

Laboratory Quality Control Data Log

MS/MSD Data

Quantitation Report File: VOL207

Data: VOL207.TI
08/23/89 1:53:00
Sample: 1083-28117,B106,40/10ML,7UL/5ML
Conds.: CWA-308
Formula: Instrument: 1050 Weight: 0.002
Submitted by: Analyst: TL Acct. No.:

AMOUNT=AREA * REF AMNT/(REF AREA * RESP FACT)
Resp. fac. from Library Entry

No	Name
1	BROMOCHLOROMETHANE
2	1,4-DIFLUOROBENZENE
3	CHLOROBENZENE-D5
4	CHLOROMETHANE
5	BROMOMETHANE
6	VINYL CHLORIDE
7	CHLOROETHANE
8	METHYLENE CHLORIDE
9	ACETONE
10	CARBON DISULFIDE
11	1,1-DICHLOROETHENE
12	1,1-DICHLOROETHANE
13	1,2-DICHLOROETHENE (TOTAL)
14	CHLOROFORM
15	1,2-DICHLOROETHANE
16	2-BUTANONE
17	1,1,1-TRICHLOROETHANE
18	CARBON TETRACHLORIDE
19	VINYL ACETATE
20	BROMODICHLOROMETHANE
21	1,2-DICHLOROPROPANE
22	CIS-1,3-DICHLOROPROPENE
23	TRICHLOROETHENE
24	DIBROMOCHLOROMETHANE
25	1,1,2-TRICHLOROETHANE
26	BENZENE
27	TRANS-1,3-DICHLOROPROPENE
28	BROMOFORM
29	4-METHYL-2-PENTANONE
30	2-HEXANONE
31	TETRACHLOROETHENE
32	1,1,2,2-TETRACHLOROETHANE
33	TOLUENE
34	CHLOROBENZENE
35	ETHYLBENZENE
36	STYRENE
37	XYLENE (TOTAL)
38	TOLUENE-D8
39	BROMOFLUOROBENZENE
40	1,2-DICHLOROETHANE-D4
41	2-CHLOROETHYL VINYL ETHER
42	1,3-DICHLOROBENZENE

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Figure 10-6a

Laboratory Quality Control Data Log

MS/MSD Data

No	m/z	Scan	Time	Ref	RRT	Meth	Area(Hght)	Amount		%Tot
1	128	232	7:44	1	1.000	A BB	136833.	250.000	NQ	16.75
2	114	470	15:40	2	1.000	A BB	407514.	250.000	NQ	16.75
3	117	578	19:16	3	1.000	A BB	308452.	250.000	NQ	16.75
4	NOT FOUND									
5	NOT FOUND									
6	NOT FOUND									
7	NOT FOUND									
8	84	140	4:40	1	0.603	A BB	16229.	20.387	NQ	1.37
9	43	150	5:00	1	0.647	A VV	5260.	14.860	NQ	1.00
10	NOT FOUND									
11	NOT FOUND									
12	NOT FOUND									
13	96	271	9:02	1	1.168	A BB	493.	0.711	NQ	0.05
14	NOT FOUND									
15	NOT FOUND									
16	NOT FOUND									
17	NOT FOUND									
18	NOT FOUND									
19	NOT FOUND									
20	NOT FOUND									
21	NOT FOUND									
22	NOT FOUND									
23	130	403	13:26	2	0.857	A BB	1667.	2.611	NQ	0.17
24	NOT FOUND									
25	NOT FOUND									
26	NOT FOUND									
27	NOT FOUND									
28	NOT FOUND									
29	43	489	16:18	3	0.846	A BB	430.	0.482	NQ	0.03
30	43	520	17:20	3	0.900	A BB	569.	1.008	NQ	0.07
31	164	527	17:34	3	0.912	A BB	377878.	637.725	NQ	42.72
32	NOT FOUND									
33	92	555	18:30	3	0.960	A BB	4249.	4.877	NQ	0.33
34	NOT FOUND									
35	106	628	20:56	3	1.087	A BB	3450.	6.435	NQ	0.43
36	NOT FOUND									
37	106	733	24:26	3	1.268	A*BB	25138.	39.173	NQ	2.62
38	98	550	18:20	3	0.952	A BB	4559.	3.222	NQ	0.22
39	95	690	23:00	3	1.194	A BV	8885.	9.045	NQ	0.61
40	63	300	10:00	1	1.293	A BB	2287.	2.262	NQ	0.15
41	NOT FOUND									
42	NOT FOUND									

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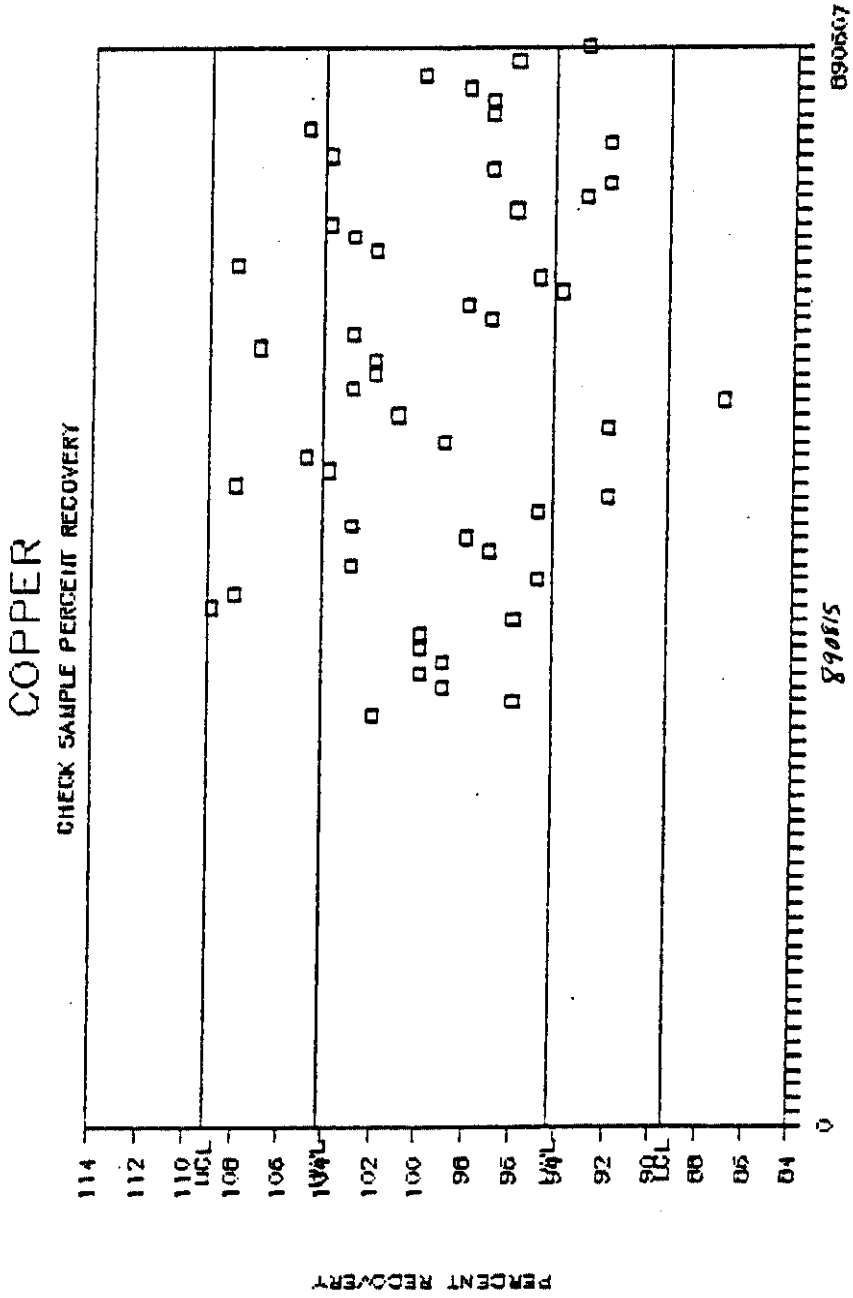
Figure 10-6b
Percent Recovery QC Chart



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ANALYTICAL METHODS

Radioactivity	- National Conference on Management of Uncontrolled Hazardous Wastes Sites (USEPA Hazardous Materials Control Research Institute), October 1981 110	
Peroxide	- Ether Peroxide Test Strips	
*	- Drum Consolidation Protocol (DRAFT) USEPA, August 1981	15.5.11
Oxidizer	- Potassium Iodide - Starch Test Strips	
*	- Drum Consolidation Protocol (DRAFT) USEPA, August 1981	15.5.11
Water Reactivity & Solubility	- Drum Consolidation Protocol (DRAFT) USEPA, August 1981	15.5.11
Flammability	- Open Flame Test	
pH	- pH Indicator Strips	
Cyanide	- Standard Methods for Examination of Water & Wastewater, 14th Edition, 1979 413-I	
*	- Standard Methods for Examination of Water & Wastewater, 14th Edition, 1979 412-E	
Sulfide	- Lead Acetate Test Strips	
*	- Drum Consolidation Protocol (DRAFT) USEPA August 1981	15.5.5
Halides	- The Systematic Identification of Organic Compounds, Shriner et al, 5th Edition, Jon Wily & Sons, New York, NY, 1964	
*	- Drum Consolidation Protocol (DRAFT) USEPA August 1981	15.5.6
PCBs	- Drum Consolidation Protocol (DRAFT) USEPA August 1981	15.5.8

* - Confirmation Test

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APPENDIX III

Wadsworth/ALERT Laboratories' Waste Compatibility and Consolidation Scheme

Wadsworth/ALERT Laboratories developed the following analytical scheme for the purpose of determining the compatibility and ultimate consolidation of unknown waste streams. It incorporates the use of commercial test strips and standard analytical methods and drum consolidation protocols as outlined in this section.

Waste Compatibility and Consolidation Scheme

Compatibility and Consolidation Groups (See Flowchart)

1. Radioactive
2. PCB Solid
3. Flammable Solid
4. Nonflammable Solid
5. Oxidizer
6. Peroxide
7. Reactive
8. Water Reactive
9. PCB Liquid
10. Sulfide Liquid
11. Cyanide Liquid
12. Flammable Nonhalogenated Organic Liquid
13. Nonflammable Nonhalogenated Organic Liquid
14. Flammable Halogenated Organic Liquid
15. Nonflammable Halogenated Organic Liquid
16. Flammable Aqueous Acid
17. Nonflammable Aqueous Acid
18. Flammable Aqueous Neutral
19. Nonflammable Aqueous Neutral
20. Flammable Aqueous Base
21. Nonflammable Aqueous Base

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WASTE COMPATIBILITY AND CONSOLIDATION SCHEME